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Cost Analysis

IF more data of the kind given in the paper read last night by Major Woodward and Mr. Carne before the I.E.E. were published, and if such information had been readily available in past years, the electricity supply industry would now know better where it stood.

Papers and other publications on tariffs we have had in plenty during recent years, but there has been little to link them up with the costs of production, on which tariffs must be based. There has, indeed, been apparent a confusion between the two, and this confusion has been responsible for a belief entertained in some quarters that equity requires a direct relation between tariffs and costs of generation and distribution.

Tariffs express the value to the consumer of electrical service, and must be designed to suit his needs; costs, as such, do not interest him, but, together with such technical matters as load, diversity, and power factors, are the province of the engineer.

In discussing tariffs without reference to a cost basis the supply industry may be said to have put the cart before the horse, since, in order to ascertain what is the minimum rate at which any load can be obtained, it is essential to have a very clear idea of the exact figure at which it could be profitably supplied.

The charge has been levelled against supply undertakings that their tariffs have been based on guessed costs, and certainly it would appear that until a few years ago the differentiation between even such fundamental factors as standing and running charges was constructed on a very flimsy foundation. This made it necessary to play for safety in quoting the low prices necessary to secure long-hour and off-peak loads. The analysis of two-part tariffs made by Mr. Bolton in this issue appears to indicate that a certain haziness still exists with regard to the proportions of fixed and running charges.

As the authors of the paper referred to point out, the usual division into kW demanded and kWh used falls considerably short of the needs of the case, and it is clear that a close investigation into the incidence of management and other overhead costs is entailed.

An interesting point brought out by the authors in the practical application of their cost analysis is that the "unit" charge in a two-part tariff suitable for domestic supplies is not necessarily correct for other supplies, as the factor governing the fixed component cannot take account of diversity. We hope in an article in a subsequent issue to produce evidence in support of this view, and to show that it applies to supply undertakings generally.

While we are in favour of the running charge being as low as practicable in all cases, it should be borne in mind that a loss on the running charge is an absolute loss on every kWh sold, and cannot, as can the fixed charges, be imposed—albeit unsoundly—on other consumers. Moreover, a running charge slightly higher than that theoretically possible enables the undertaking to supply consumers whose load factors are likely to improve at attractive rates that may show little profit in the early stages, but which may be expected to provide a reasonable return later.

The analysis given in the I.E.E. paper is based upon the experience gained by a power company that was, we believe, the first in this country to realise the essential part that must be played in development by the consumers' department. The procedure described, which obviates the necessity of reference to first principles in every case where costs of production are concerned, follows logically from this conception of electrical development.

Springtime Opportunities

Now that April's here and the annual domestic revolution is in full swing many openings occur for the electrical industry. There is a tendency to think of the vacuum cleaner as the pre-eminent springtime appliance, but the field is far wider than this. Supply authorities' canvassers should be able to show many a householder that the redecoration of a house provides an appropriate occasion for the installation of electricity. They can give an assurance that the next call for the painter and paperhanger will be long delayed by the use of electricity in the place of coal and gas. The lamp seller can persuade those who already enjoy the benefits of electricity to fill empty

sockets and replace lamps which have been in service too long. Occasional heating is a necessity of spring, and how better can this be provided than electrically? Then again with the kitchen range less in demand, although hot water requirements remain the same, electric water heaters satisfy the need most satisfactorily. More daring electrical men can remind the "prospect" of the torrid days ahead and sell him a refrigerator; they will not be called upon to guarantee fulfilment of their prophecy if their apparatus gives good service. At this time of the year the ordinary human being is receptive to new ideas, and becomes adventurous, and electricity suppliers and sellers of electrical apparatus should hasten to present these new ideas and book the orders which should inevitably result.

A Hint!

Sir Alexander Roger stated that toward the end of last year the whole of the employés of the Anglo-Portuguese Telephone Co., Ltd., were engaged in a telephone canvassing drive in their spare time, with the result that 1827 new stations were added in five weeks. Which sets us wondering what might happen if certain British electricity supply undertakings similarly employed their staffs!

The Cooker Campaign

Mr. A. C. Cramb, Director of E.D.A., chose Manchester as the place for a public announcement of a cooker campaign which is to be started almost immediately. The North-Western Area is the largest area of the Association, and it was at its annual luncheon that this important reference was made. At the same function Mr. C. H. Cox, the new Chairman of the E.D.A. Council, said that Manchester, Salford and Liverpool Corporations had given the organisation strong support and he took occasion to stress the importance of securing bigger funds if it was to perform efficiently as a central publicity organisation. Mr. Cramb intimated that in the cooker campaign every endeavour would be made to eliminate all technical terms from their propaganda. In this the Association shows that it intends to profit from criticism levelled at previous campaigns. We electrical men have simply got to speak to the general public in terms that they will understand. The notices issued by some engineers and managers are altogether too highbrow, too abstruse, and two complicated in detail. Electricity supply authorities must convince householders that electric cookers are easy to get; that they can be relied upon; that maintenance men are always available; that it pays to have a good thing; and that what the gas companies' representatives suggest or hint at is often untrue.

Joint Authority Distribution

Criticism of the London and Home Counties Joint Electricity Authority that has appeared in the daily Press attaches insufficient weight to certain recent developments. It has been suggested that the Authority no longer fulfils the purpose for which it was created, and that the vesting of responsibility for generation and interconnection in the Central Electricity Board has made the lesser body redundant. It is true that the vetoing of the Chiswick station altered the position and prevented the London J.E.A. from developing on similar lines to other authorities, and the indispensability of a purveyor of bulk supplies that acts only as an intermediary might be open to question. But the London J.E.A. has now become a distributor and in at least two important respects has done good service. The first is by taking over the rights of small local authorities to purchase portions of company undertakings in their districts which might have caused technical difficulties later on; the other is in co-ordinating tariffs over a wide area. Reductions in charges in these areas may also be counted to the credit of the Authority, as although some of these might have been introduced by the former owners of the undertakings but for the uncertainty of their tenure, the magnitude would probably have been less. Further reductions are anticipated which we hope will take the form of lower running charges for heating and cooking.

Still Falling

Electricity supply figures received from the United States do not furnish very cheerful reading just now. The largest decreases reported for the last week in March (16.6 per cent.) occurred along the Pacific Coast, but the central industrial region, which includes Buffalo, Pittsburg, Cincinnati, St. Louis, and Milwaukee, was 13.9 per cent. lower than a year ago, while the Chicago district was down by 9.8 per cent. A London newspaper dispatch, dated New York, April 6th, told of an all-round decrease of 11.9 per cent., and commented upon the fact that, in addition to being regarded as a general trade index, the figures were adversely affecting public utility stocks. The Middle West Utility Companies (the Insull group) have been the subject of conferences between Mr. Samuel Insull, the New York and Chicago bankers, J. P. Morgan & Co., and the General Electric Co. (of America), which provides equipment, owing to complications that have arisen. There are many reports in the Press about applications for the appointment of receivers, the organisation of committees, a new holding company, and so on. One outcome may be the reorganisation of the Insull financial structure with a heavy scaling-down of share capital. The real situation is not very clear at the moment.

The E.A.W. Conference

The two-day conference of the Electrical Association for Women opened yesterday. The novel feature this year was the presentation of the first "electrical housecraft diplomas," whose holders may be regarded as the forerunners of a new trained force at the disposal of the industry in its determination to secure the domestic cooking and heating load. The ball to-night is being given in aid of the funds for the new offices of the E.A.W., which we trust will soon be found in a more central part of London than they are at present.

Power Station Efficiencies

What relation does the thermal efficiency of generation bear to system load factor? Not a very close one; yet it is used officially to weight the basis of comparison between the operating performances of different stations supplying a kWh for approximately the same number of B.th.u Plant load factor tempered by form factor would be a better guide, but these, even if obtainable, would not give the accuracy required by grid conditions, which postulate the use of the most economical plant. In this issue Mr. S. B. Jackson suggests a method of comparison that is as interesting technically as it is practicable. It is claimed that the use of such a method enables a power station performance to be expressed rationally and with reference to its own appropriate standard. Other standards, such as the Parsons Line, do not take into account such influences as the plant test performance, steam, temperature, pressure, vacuum conditions, and load factor, and for this reason the present proposal commends itself, because it appears to include every relevant influence on the station performance.

Cable Armouring

The question as to the tests required on galvanised wires for cable armouring has been settled by the new British Standard Specification (No. 443—1932) which deals with the method of examining the zinc coating by means of a standard copper sulphate solution. In view of the uncertainty that has existed on the subject for several years, it is very satisfactory to have at last an agreed method of testing.

Comparing Station Performance. By S. B. Jackson, A.M.I.E.E.

A standard method of correlating thermal efficiencies

IT is impracticable to gauge the efficiency of a generating station without some criterion of its potential performance, as plant efficiencies, terminal conditions, load factors, &c., exert a considerable influence on the final result. Thus it may be desired to compare the performance of two well-known stations giving the following results :—

	kWh. Generated.	Max. load.	Load factor %.	Thermal efficiency.
Station "A" ..	129,624,646	35,000	42.3	23.84
Station "B" ..	280,819,210	74,000	43.3	23.20

The performances cannot be compared without resorting to some standard.

The standard adopted should be applicable over the whole range of station loading; be as simple as possible; obviate intricate calculations; be capable of showing a continuous record of the station performances for any load; and should assume the most efficient combination of plant at any load which involves the most efficient sequence of operation of all items.

Mr. S. B. Jackson, who is on the engineering staff of the Central Electricity Board, has made a special study of power-station efficiencies

To determine this sequence of plant operation, a knowledge of the test results of each boiler and turbine and boiler unit is necessary. A complete analysis of all station losses is essential, and it may be necessary to determine how some of these losses vary as a function of the station loading. These data may be plotted against station loading and expressed as plant efficiency factors.

Due recognition should be given to anything which influences the station thermal efficiency, and the curves should be adjusted so as to represent the practical conditions as nearly as possible. Losses should be judiciously estimated, but this is not difficult in a station where each item of performance has been customarily subject to analysis.

As plant may become less efficient due to length of service, the curves will have to be redrawn annually. When new plant is put into service or old plant withdrawn, new curves should be prepared. The curves reproduced below are based on a station having the following plant and steam conditions: pressure at turbine stop valve, 350 lb. per sq. in.; temperature, 750 deg. F.; vacuum, 29.0 in. Hg.; boilers, four 100,000 lb. per hr., remainder 75,000 lb. per hr.; turbo-alternators (n.e. rating), two 28,000 kW, two 25,000 kW, two (house) 1,600 kW. The main turbines have three-stage feed heating and evaporators in their feed-heating cycles.

Losses in Operation

Drips and drains losses largely depend upon the degree of maintenance, and it is possible to exercise control over them so that they are almost imperceptible. A figure of 0.5 per cent. has been chosen for the present example; adding this to a similar quantity for boiler blow down loss, a total of 1.0 per cent. seems equitable, giving an efficiency factor of 99.0 per cent.

Losses due to radiation and throttling in piping vary but little over a wide range of station loading. In general, these losses will not be more than 3.0 per cent. at full station output, and about 1.0 per cent. at 25 per cent. station output. The curve shown gives 2.5 and 1.0 per cent. losses at full and 25 per cent. station outputs respectively, and at the higher loading may be considered as on the high side.

Efficiency factors of 97.5 and 99.0 per cent. have been allocated. The banking loss should be obtained from a separate test of each boiler and the maximum banking coal (with only one boiler on load and all others banked) determined. The loss can be expressed as a percentage of the total coal requirements over the range of station loading, on the assumption that the total banking coal of all boilers will be required when only one boiler is in service, and zero banking coal when the last boiler is put on load. A regular characteristic may be drawn where the loss is expressed as a function of station loading.

For the present example the chosen efficiency factors are 97.5 per cent. at the point when the second boiler is put on load and 100.0 per cent. when the thirteenth boiler is put on load. An important aspect of these losses is the character of the load supplied from the station. It may be necessary for the station to stand by for a quickly rising load at a definite time of the day, as when industrial loads or traction predominate, and the curve should be adjusted to satisfy the circumstances. In the present case it has been considered sufficient to draw a regular curve over the appropriate portion of the station loading.

In boiler test results a certain amount of energy for auxiliaries is accounted for, necessitating a slight deduction from the total station auxiliary energy requirements. Items such as coal handling and ash pumping plant, and other boiler-house auxiliary motors should appear in the total station figure. All electrical services (*e.g.*, office heating) which are not essential to the generation of energy should be separately metered, but not included. A factor of 96.0 per cent. has been taken for the present example.

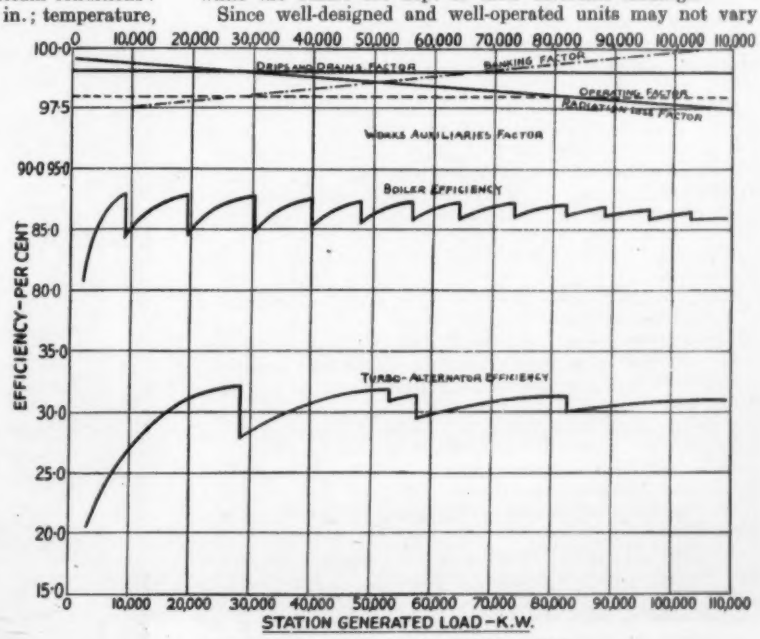
In general, works auxiliary energy is not a function of station loading and can be represented as constant over the full range of output. Where this condition does not hold, due regard should be paid to the circumstances.

Where turbines have evaporators incorporated in their feed-heating cycles, the turbine tests are conducted to allow for the continuous production of a definite quantity of make-up, in the present instance 4.0 per cent. This provides a criterion for the theoretical make-up requirements. If the station requirements are less than that allowed for in the turbine tests it is to the station's advantage, but it is impossible for them to be more. In stations with separate evaporators, the previous minimum value achieved should be taken as a suitable practical datum point, because a theoretical minimum value of make-up cannot be reliably estimated. Where both systems are in use, a judicious combination should be made depending upon local conditions.

Plant Running Programme

The boiler curve is based on the assumption that boilers are put on load in accordance with their test efficiencies at the normal economic rating at the specified pressure and temperature. The boilers are put on load in sequence determined by their relative efficiencies, the least efficient boiler at a particular loading being used for steam pressure regulation while the others are kept at their economic loadings.

Since well-designed and well-operated units may not vary in their thermal efficiencies by more than 4.0 per cent. between 60 per cent. and their normal economic loading, the



Generating station performance curves

effect on the thermal efficiency curve is negligible, and as more boilers are put into service the effect is decreased. Strictly comparative tests should be made on each boiler to determine its thermal efficiency. A gradual fall in efficiency has been taken for each boiler of approximately 0.2 per cent., commencing with 87.9 per cent. for the first boiler and the curve calculated accordingly. The last boiler has been assumed to be operating at 82.0 per cent. efficiency on pressure regulation only.

The most economical manner of loading turbo-alternators is in accordance with the following method. From an analysis of the Willan's line of each machine (which usually follows a straight line law) the equations of the steam consumption of each machine should be obtained and corrected to the specified terminal conditions. Assuming the station to be on full load, as the station load falls the load on the machine with the highest second term of the equation should be lowered and eventually taken out of service.

A characteristic of the station steam consumption can thus be obtained. Similarly, the characteristic may be expressed in terms of heat consumption by using the heat consumption curve of each machine, which is approximately a straight line for given terminal conditions; this has been done in the present case.

The preparation of the characteristic was slightly complicated by the use of two house-service machines. It was decided to assume that one machine would be in service up to half the total capacity of the main generators and both machines beyond that figure, the balance of the auxiliary energy being supplied from the main station bus-bars.

The increase of load on these machines was assumed to be gradual up to the above limits, and from a knowledge of the heat consumption the combined curve was drawn. The small depression at 53,000 kW is due to the second house service machine being put on load. The maximum load on each machine is that of its normal economic rating, at which point the next machine is put into service.

Losses over which it is almost impossible to exercise control include opening of boilers on to the line, the warming and running up of machines, and the gradual increase of deposits on boiler or condenser tubes; moreover, plant cannot be strictly operated to a theoretical value of plant efficiency, even if the correct sequence be adhered to. These losses should be classified under the heading of an operating factor, which should be taken as 98 per cent. in all cases, as it represents a reasonable value to expect in any station.

Component Efficiency Factors

Now let each factor be represented as follows :—η_a = drips and drains, η_b = radiation, η_c = banking loss, η_d = make-up, (where necessary), η_e = works auxiliaries, η_f = boiler efficiency (including feed pumps), η_g = turbo-alternator efficiency, η_h = operating factor, η_t = theoretical station thermal efficiency.

Then, for any load $\eta_a \times \eta_b \times \eta_c \times \eta_d \times \eta_e \times \eta_f \times \eta_g \times \eta_h = \eta_t$.

If η_x = actual station thermal efficiency factor, it follows that η_x/η_t indicates the degree of performance of the station (1),

Now η_t = theoretical value at the specified steam and vacuum conditions for which the curves were prepared.

But it is necessary to determine the influence of the actual steam and vacuum conditions and to find the extent of their utilisation.

The performance curves are based on standard boiler and turbine steam temperature, pressure, and vacuum conditions. The turbine efficiencies are the highest attainable in practice, and under actual operating conditions they will vary but very slightly; with variations for terminal conditions and for purposes of simplicity they can be regarded as constant. Any increase or decrease of overall thermal efficiency may be attributed to an increase or decrease of the heat drop in the working fluid.

Let η_{sr} = Rankine efficiency at the specified conditions, and η_{ar} = Rankine efficiency at the actual conditions. Then $\eta_t/\eta_{sr} = \beta$ = overall equivalent plant item efficiency factor, per cent. So that $\beta \times \eta_{ar} = \eta_{tc}$ where η_{tc} equals the theoretical thermal efficiency corrected to actual Rankine cycle conditions.

Let the half-hourly kWh sent out = η_{tc}, from which the equivalent electrical input, I_t, of the station can be calculated.

Then kWh sent out per annum/sum of the half-hourly I_t values = average theoretical thermal efficiency η_{tc}.

So that from (1) we have η_x/η_{tc} = annual factor of performance of station, which has been suitably adjusted to the particular load conditions obtaining, the station load factor, and the actual turbine terminal conditions.

For each value of I_t the following information will be required :—(*a*) η_t from the curves; (*b*) kWh sent out from the switchroom readings; (*c*) average boiler steam pressure and temperature from the boiler-house log-sheet; (*d*) average vacuum from the engine-room log sheet; and (*e*) the Rankine cycle efficiency for the actual conditions. The last may be read directly from specially prepared curves or from the following formula :—$\frac{H_1 - H_2}{H_1 - (T_2 - 32)}$, where $H_1 - H_2 = H_r$ = the adiabatic heat drop, H_1 = total heat in steam, T_2 = the condensate temperature. H_1 and H_r may be conveniently obtained from the B.E.A.M.A. Tables, 1931, and the Callender Heat Drop Tables, 1931, respectively.

A Practical Standard

If the actual terminal conditions vary above the specified conditions the station is appropriately penalised, so that no station would be able to return a performance factor which was partly assisted by a variation of the terminal conditions. Similarly, a station which obtained a thermal efficiency when the actual Rankine conditions were lower than those specified would be credited with a suitable proportion which would cover only the appropriate number of units sent out.

Turbine efficiencies have not been corrected for variations above or below the specified conditions, because these approximately cancel each other and further unnecessary complications would be introduced. Taking an example for a half-hourly period in order to illustrate the use of the curves and formulæ :—

	Standard Conditions.	Actual. Conditions.	
Steam pressure (Abs)	390	394	
Steam temperature °F.	775	768	
Vacuum, inches	29.0	29.09	
Efficiency per cent. Rankine ...	37.16	37.35	
from curves	24.0	24.09	(corrected)
Load kW	70,000	70,000	(value)
kWh sent out	67,000	67,000	

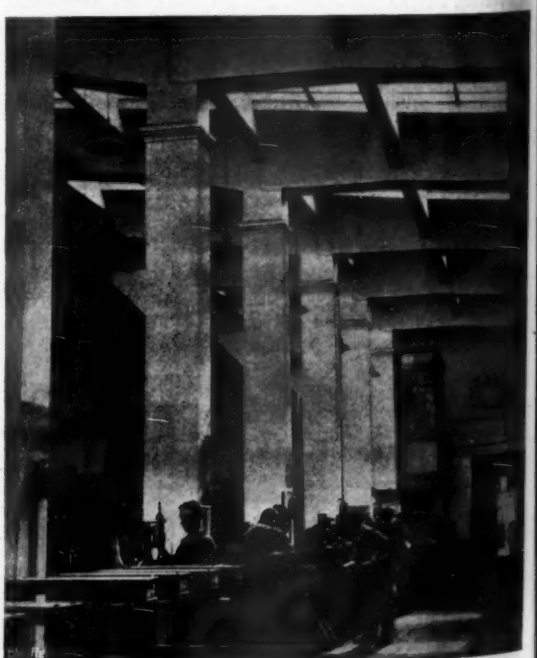
The value would be $\frac{67{,}000 \times 100}{24.09} = 278{,}000$ (for half-hourly use). Suppose the actual thermal efficiency obtained was 22.9 per cent., then, 22.9/24.09 = 95.0 per cent. (approx.) = factor of performance.

We can now write for a station the following hypothetical data :—

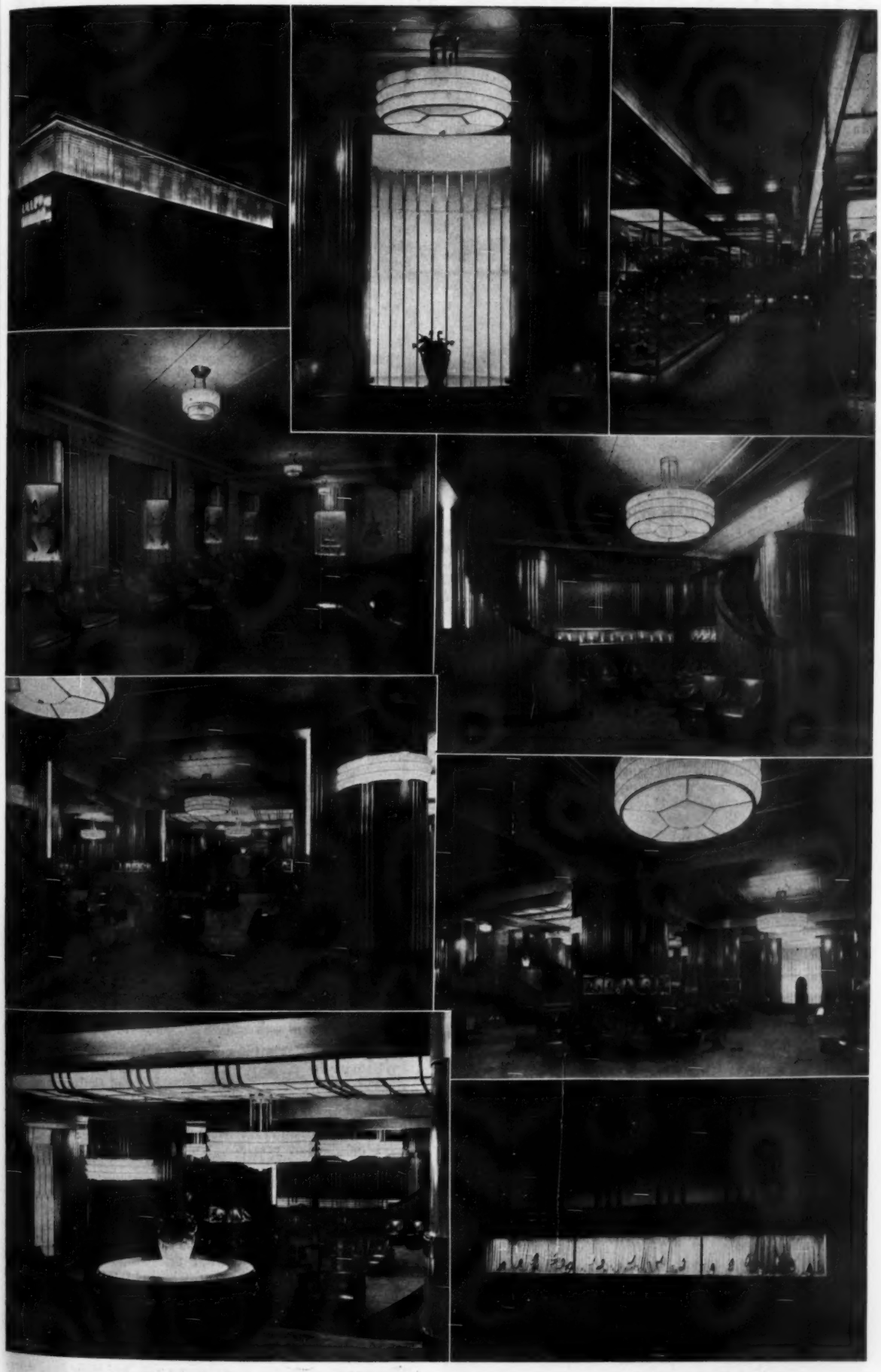
kWh generated	Max load K.W.	Load factor %	Thermal efficiency	Performance factor %
300,000,000	95,000	36.1	23.90	96.2

where all the required data of the station performance are complete. The number of kWh generated, the nature of the load as indicated by the load factor, the actual thermal efficiency, and the quality of performance in obtaining this thermal efficiency are shown, with due regard to all the relevant considerations influencing the station thermal efficiency apart from the load factor.

In the case of stations employing two or several sets of steam pressure and temperature conditions, the plant associated with each range of conditions should be considered as a separate station and curves prepared accordingly. The half-hourly values of I_t should be ascertained in accordance with the plant connected to each section and the kWh generated in each section.



The former Siemens & Halske factory, Leningrad, where railway signal apparatus, radio equipment, &c., are produced (see page 555)



The Effective Use of Light as a Decorative Medium at Messrs. Lilley & Skinner's, Oxford St., W. (*See page 559*)

Fixed and Running Charges. By D. J. Bolton

Their proportionality in two-part tariffs

AMID all the bewildering welter of tariffs, actual and proposed, there is one principle which still stands out clear and unquestioned. Whatever form the tariff may take it must be in some way related to costs, and these costs in their turn are bound to take a two-part form. Even if the price quoted for electrical service is simplified into a single over-all figure or elaborated into a tariff of three or more parts, the central idea of fixed costs and running charges forms the backbone of the costs analysis.

When the supply engineer contemplates a given addition to his load and discusses at what figure he can afford to sell, he must have at the back of his mind an estimate as to how much the addition will increase the maximum load on his cables and station on the one hand and as to how much it will increase the working charges on the other. So long as expensive plant is required to generate and transmit, and so long as inexpensive local storage is impossible, so long will the principle laid down by Crompton and Hopkinson have relevance and importance.

This being so, it is surprising how little serious study has been made of the two-part tariff, and in particular of the proportion which the two parts should bear to one another.

A more fruitful subject of study hardly exists at the present time, and a survey of existing literature on this matter will show that an undertaking which determines to quote a two-part tariff for any particular class of supply has almost no guidance whatever on this point outside its own particular experience.

Ratio of Component Charges

Much has been made of the variations both in kind and in magnitude of the different tariffs offered to the public in this country. But a more surprising thing has passed almost unnoticed, namely, that even in the case of a perfectly standard method of charging, such as the two-part tariff based on kW of demand and kWh consumption, there are enormous variations in the ratio which the two parts bear to one another.

It might be thought that, in so far as the tariff was based on costs, the proportion of fixed to running expenses should not vary greatly from station to station, while in so far as these figures are modified on grounds of policy the same sort of modifications would generally prevail. It will be seen, however, even in the brief summary which is possible here, that any such unanimity is far to seek; in fact, the proportions of the tariffs vary even more than do their magnitudes.

As an illustration of the importance of correct proportionality, both to consumer and to supply authority, consider two alternative tariffs, namely, £5 per annum per kW, plus 0.3d. per kWh, and £3 per kW, plus 0.5d. per kWh. At 27½ per cent. load factor these two will give the same over-all price per kWh (0.8d.). If the undertaking's power consumers average this load factor the same revenue will be forthcoming from either tariff—receipts will balance expenses, and all (apparently) will be well.

But for consumers with very large or small load factors the incidence of the two tariffs will be entirely different. Thus a 10 per cent. load factor consumer will pay 25 per cent. more by the first tariff than by the second. A satisfactory average of receipts must not, therefore, be allowed to obscure the fact that the tariff may be quite unjust in its proportions, and may not encourage additional consumption.

Relation Between Tariffs and Costs

It is obvious that for an undertaking generating its own supply the tariff proportions should correspond in some way to the costs, modified, if necessary, so as to make the tariff more attractive to consumers. To an undertaking buying in bulk the matter is even more important, since the costs in this case are less flexible, being rigidly linked to a particular purchase price (usually on a two-part basis). The selling tariff must then have strict regard to this purchase price allowing for management and distribution costs.

A study of the subject may be divided into three parts: first, the actual tariffs; secondly, the costs of supply; and, finally, the explanation of the discrepancy which exists between them, and any helpful conclusions for the framing of future tariffs. The subject was raised in a previous article,* but may now be amplified with the help of the latest available figures.

Limiting the field to figures for this country in the period 1929-30, the only tariff considered is the "straight" two-part one of a fixed charge per annum on the maximum demand plus a running charge per kWh. When the fixed charge is per kVA this will be multiplied by 1.25 (assuming a power factor of 0.8), so as to provide a basis of comparison with the kW tariffs.

* Electrical Review, May 30, 1930.

In order to study the proportions which the two parts bear to one another, the word "ratio" will be used to indicate the numerical ratio between the fixed charge in £ p.a. per kW and the running charge in pence per kWh. Thus tariffs of £5 per kW, plus 0.2d. per kWh, and £4 per kVA, plus 0.5d. per kWh, would have ratios of 25 and 10 respectively.

Analysis of Tariffs

In all, 189 two-part tariffs were totalled and the mean value of the ratio between the two parts was 10.1. An investigation some two years earlier disclosed 146 tariffs with an average ratio of 12.5, indicating a considerable growth in popularity of the two-part tariff, coupled with a reduction in the ratio. As regards the first point, however, it should be said that in the earlier investigation the net was not quite so widely spread. The present average of 10.1 covered a variation between very wide extremes, as will be seen below.

For the purpose of analysis the tariffs were placed into three groups. Group A covers high-voltage and bulk supplies, and special terms granted to large consumers. Group B includes all the normal power supplies; whilst Group C covers lighting and domestic supplies, including business houses, cinemas, etc. The results in the three groups were as follows:—

Group.	*No. of Tariffs*	*Average of Ratio*
A (bulk and h.v.)	40	10.9
B (normal power)	103	9.5
C (lighting, etc.)	46	11.0

It was expected at the outset that some definite tendency would be revealed as between the different groups. Thus it might be anticipated that there would be a general difference between A and B on cost grounds in the direction of a higher ratio for Group B, since distribution would add a greater amount to the fixed charges than it did to the running costs.

It might also be expected that a difference would appear between Groups B and C on grounds of policy due to the different situations of the two classes of consumers.

A Constant Ratio

The results, however, did not bear out any such anticipations. Although sufficient records were scheduled to bring out any tendencies of this kind which really existed, the figures show a remarkably close approximation to a ratio of 10 in each of the three groups. It would, in fact, appear either that the differences in cost ratio between generation and distribution are in some way cancelled out (this possibility will be discussed later) or else that supply engineers are not omniscient after all and are just as capable of drawing figures out of a hat as other people.

In support of the latter theory it is only necessary to glance at some of the variations which exist, even within the field of single undertakings. Thus in the case of Leicester Corporation the fixed charge is the same for h.v. bulk supply as for l.v. distribution, although the unit charge is 4½ times as great for the latter; as a result the ratio between the two parts is 9.6 for h.v. and under 2 for l.v.

Sheffield Corporation and the Scottish Supply Company are other examples in which the fixed charge is the same for both A and B Groups, although the kWh charge for the latter is double or over. Such a tariff would appear to be designed to avoid frightening a small consumer with too high a fixed charge, since in the matter of costs it can hardly be suggested that the extra distribution only affects the running expenses.

Variations in Fixed Charges

The opposite practice, namely, of keeping the kWh charge the same and varying only the fixed charge, finds a number of adherents. Thus Bolton, Canterbury, Rochdale, Salford, and Warrington Corporations and others charge the same price per kWh for both supplies, although the fixed charge is twice or more on the low pressure. In spite, however, of a number of examples of the kinds mentioned, most undertakings quoting both h.v. and l.v. prices vary both parts of the tariff simultaneously whilst keeping the ratio approximately the same.

Another way, which may be noted in conclusion, of solving the ratio problem is to leave the onus on the consumer. This tendency is represented by undertakings such as the Metropolitan Electric Supply Co. and Fife Corporation which quote alternative prices, one having a high fixed and low running charge and the other *vice versa*. Thus the former undertaking quotes two tariffs for energy at the same point, one of which has a ratio four times as great as has the other.

The growth in popularity of power factor tariffs is, incidentally, shown by these investigations. Two years ago 29 per cent. of the two-part power tariffs had their fixed charge based on kVA rather than kW; in the present inquiry the proportion was found to have risen to 38 per cent.

Electrical Manufacturing in Russia. By G. Shapiro, A.M.I.E.E.

Organisation and production of a 375 million rouble combine

THE manufacture of electrical machinery, transformers, switchgear, instruments, lamps, and electrical apparatus generally in Russia is controlled by an organisation called "V.E.O." (All-Union Electrical Corporation), comprising thirty-four works, of which fourteen are in the Moscow district and fourteen in the Leningrad district. The principal works of "V.E.O." are: "Electrosila," Leningrad (electrical machinery); "Electrozavod," Moscow (transformers, lamps, and rectifiers); "Electromechanichesky Zavod," Kharkov (electrical machinery and switchgear); "Dynamo," Moscow (traction motors and equipment); and "Electroapparat," Leningrad (switchgear).

The first three of these works are the largest, employing 10,000, 24,000, and 18,000 men respectively, including the staff. The technical personnel forms about fifty per cent. of the staff. The capital invested in the "V.E.O." concern is estimated at about 375 million roubles, and during 1931 it produced goods valued at 925 million roubles.

In addition, there are also the works built by A.S.E.A. in Jaroslavl under a concession for the manufacture of three-phase motors up to 700 h.p. The output of these works will represent 7-8 per cent. of the motors manufactured in the U.S.S.R.

Large Machine Construction

As can be surmised, the activities of "V.E.O." are many and varied, and below are indicated some of the achievements of their principal works. Several 24,000-kW, 3,000-r.p.m. turbo type alternators have been built at "Electrosila" works, and also one 50,000-kW 1,500-r.p.m. alternator, which is already working at Kashira station. These two sizes are now being manufactured in series. Detailed designs of a 50,000-kW 3,000-r.p.m. alternator are practically completed, and it is anticipated that one such machine at least will be built during this year.

Alternators for water turbines of 4,000 kW at 6,600 V and 8,750 kW at 11,000 V have been manufactured since 1927, and

The "All-Union" Electrotechnical Institute, Moscow

at present the "Electrosila" works has under construction four 13,000-kW and one 62,000-kW slow-speed alternators. The latter is intended for the hydro-electric station on the river Dniepr.

A notable achievement is the design and construction of the electrical equipment for a very large blooming mill, designed for an output of 1,000,000 tons of blooms per annum. The electrical machinery was manufactured at the "Electrosila" works and the switchgear and control apparatus at the Kharkov works. The equipment comprises the main reversing d.c. motor (7,000 h.p., 50-120 r.p.m.); Ilgner system d.c. generating plant, consisting of two 3,000-kW 375 r.p.m. d.c. generators connected in series; a 202,000 h.p.-sec. flywheel; and a 5,000-h.p., 6,600-V a.c. motor; excitation set, switchgear, &c.

Converters and Transformers

Rotary converters up to 1,000 kW, synchronous condensers up to 5,000 kVA, and also phase compensators were delivered in 1931. Designs for synchronous condensers from 5,000 to 25,000 kVA have been worked out, and the first machine will be completed in 1932. Many of the motors that are being produced at present are of new design and have a much better performance, and are considerably lighter than those formerly manufactured. In some types the frames are of welded construction. Considerable quantities of motors for special machines, such as coal-cutters and oil-well drilling machines, have been manufactured, and will be produced in much larger quantities, as the demand is growing.

A 25-kW, 10,000-V d.c. generator is under construction at present, and a 50-kW, 80,000-V machine is being designed. High-frequency machines of 50 kW and 150 kW have already been built, and a 500-kW machine is under construction.

Power transformers are at present manufactured at the "Electrozavod" in Moscow. The manufacture of transformers up to 20,000 kVA, 38,000 V, has been fully established. Experimental transformers of 20,000 kVA, 110,000 V, have been made, and during this year they will be regularly pro-

Wire enamelling machines at the "Sevkabel" Works, Leningrad

duced. The total capacity of power transformers installed in the U.S.S.R. by 1927-28 was 2,000,000 kVA. During 1931 alone, however, the "V.E.O." works produced 3,840,000 kVA, but this satisfied only about 25-30 per cent. of the requirements. It is estimated that during 1932 about 5,800,000 kVA of transformers will be required, and of this capacity the existing "V.E.O." works will be able to supply only about one-third. New transformer works are being built at present in Moscow which, when fully completed, will be able to produce annually 1,200 transformers, aggregating 10,000,000 kVA.

Only certain types of low-pressure apparatus were manufactured formerly in Russia. As regards h.p. apparatus, it was necessary to start from the very beginning. At present h.p. switchgear is manufactured at the "Electroapparat" works, in Leningrad, and l.p. switchgear at the "Electromechanichesky Zavod," Kharkov. One 110-kV oil switch having a rupturing capacity of 1,500,000 kVA has been built, and during 1932 such oil switches will be normally produced. Designs of a 11-kV oil switch with a rupturing capacity of 2,500,000 kVA have been worked out, and it is expected that one such switch will be completed in 1932.

Foreign Assistance

"V.E.O." has now working arrangements with the General Electric Co. of America, and the Metropolitan-Vickers Electrical Co., Ltd., and, with the technical assistance of these concerns, it is proposed to produce during 1932 and 1933 150 new types of apparatus.

Considerable success has been attained in the construction of mercury rectifiers. Two large examples of the

Lamp department of the "Elektrozavod," Moscow

metallic type were manufactured by "Electrosila" in 1931. Prof. Vologdin has developed a system of low-voltage and high-voltage glass mercury rectifiers, which is very economical, simple, and steady. Bulbs having a capacity of 90 kW at 12,000 V have been developed.

Electrometallurgy has a wide field of application in the U.S.S.R., and much development work is being done in connection with electric furnaces. A high-frequency induction furnace of 90-kVA capacity, which is capable of melting 150 kg. of steel in one charge, has been built. A furnace with an output of seven tons per twenty-four hours is being designed at present.

Mention should also be made of electric welding, which is being extensively used in steel construction, machine building, shipbuilding, boiler works, and many other fields. The stator frames of the 50,000-kW and 68,000-kW alternators for Dnieprostroi are of welded construction. The manufacture of welding machines commenced in 1926-27, when twenty machines were built. In 1929-30 about 2,000 machines were made, and during 1931 nearly 6,000 machines were delivered.

Welding machines are manufactured at the "Electric" works. New types of welders have been developed, among them being multi-operator machines, with a capacity of 1,500 A, automatic welders, spot welders, butt welders, and roller

Assembling meters at the Leningrad Electrical Instrument Works

welders. The "Electric" works is being extended at present, and when completed will have an output of 20,000 welders, transformers, &c., per annum, estimated at 50-60 million roubles.

Radio and Cables

The achievements of "V.E.O." in the "weak-current" field include the production of many new types of lamps of various sizes up to 5-kW, valves, the construction of several 100-kW transmitting stations, equipped with apparatus entirely of Russian manufacture, mass production of three and four valve all-mains receiving sets, sound and television apparatus, multiple telegraph and telephone equipment, automatic telephone exchanges, &c.

This industry was already firmly established in Russia before the war, supplying practically all the needs of the country. The existing three factories have been modernised and extended, and they are able to satisfy the present-day requirements practically entirely. In 1931 the "Sevkabel" Works in Leningrad produced 4 km. of 110-kV oil-filled cable, which has been laid and will serve as an experimental line for study and research. These works have also made experimental lengths of a 220-kV cable and of a 380-kV bare conductor, which are being tested at present.

A method has been devised and applied in the works for the electrical impregnation and drying of cables.

Research Institutions

Extensive research work is going on at present in the U.S.S.R. in the various research institutions and laboratories, and the following institutions are of particular importance to the electrical and allied industries.

The Thermotechnical Institute in Moscow is designed for the study of all questions appertaining to heat. It has a large power station attached to it, where new apparatus can be tested under actual working conditions, and which will be shortly equipped with a new h.p. boiler plant.

The All-Union Electro-Technical Institute in Moscow is equipped with large laboratories for the study of problems connected with high-pressure electrical machinery, switchgear, &c.

The Electrophysical Institute, Leningrad, is building at present an experimental transmission line, 1.5 km. long, to operate at 500,000 V.

The Research Laboratory of the Polytechnic Institute, Leningrad, is connected by means of a special transmission line with the Electrophysical Institute for the study of problems connected with high voltage. The "V.E.O." concern also possesses research laboratories.

Many problems in pure science, as well as the practical needs of the various industries, have been studied in all these institutions, and discoveries of the greatest importance are continually being made by the research workers. Of more than passing interest may be the latest discovery made at the Electrophysical Institute concerning a new method of transforming mechanical energy into electricity, which permits the construction of electrical machines without magnetic materials, by creating magnetic fields by means of Foucault currents.

Electrical Progress

The development which has taken place in the U.S.S.R. during the past few years can be judged from the following comparative figures. In 1925 the Russian production of electrical energy represented 2.4 of the world's total; in 1931 it had risen to 4.8 per cent. In 1928 Russia occupied eighth place in this respect; in 1931 it reached seventh place; and this year Russia anticipates that it will reach third, if not second, place.

As regards electrical manufacturing, the U.S.S.R. increased her share of the world's production from 1.4 per cent. in 1925 to 10 per cent. in 1931. From seventh place in 1928, it is hoped that Russia will rise to third place this year.

The rate of development is very high, and probably unprecedented in the past in any part of the world, but the needs of the growing industries are on such a scale that the home production is not yet sufficient to satisfy the requirements. During 1931, for instance, the Russian electrical industry supplied the requirements of the principal articles as follows: Electrical machinery, 60 per cent.; h.p. apparatus, excluding oil switches, 70 per cent.; transformers and oil switches, 15-25 per cent.; and accumulators, 52 per cent.

The balance had to be, of course, imported from abroad. For the whole of the industry, imported goods represented 17 per cent. in 1928-29 and about the same proportion in 1931.

This Year's Programme

During 1932 it is proposed to install 1,500,000 kW of new generating plant, which is 50 per cent. more than during last year.

It is estimated that for the new stations, the existing works of "V.E.O." will be able to supply the required equipment only to the following extent:—24,000-kW alternators, 50 per cent.; 50,000-kW alternators, 50 per cent.; h.p. transformers, 32 per cent.; h.p. oil switches, 20-25 per cent.; and reactors, 60-70 per cent.

In order to be able to satisfy future requirements to a larger extent, several new factories are being built at present, of which the following are worthy of mention:—The Turbine Works in Kharkov, with an ultimate output of 2,500,000 kW of plant; and the Electrical Works in Moscow, comprising the sections for producing h.p. transformers, switchgear, lamps, stampings for all "V.E.O." works, insulating material, and mercury rectifiers.

The estimated cost of these works is 135,000,000 roubles. The mercury rectifier shops will be completed during this year, as well as some of the shops of the transformer and switchgear sections. Several works are being generated for the manufacture of alkaline and acid accumulators, carbons and electrodes.

A New Electro-Technical Combine

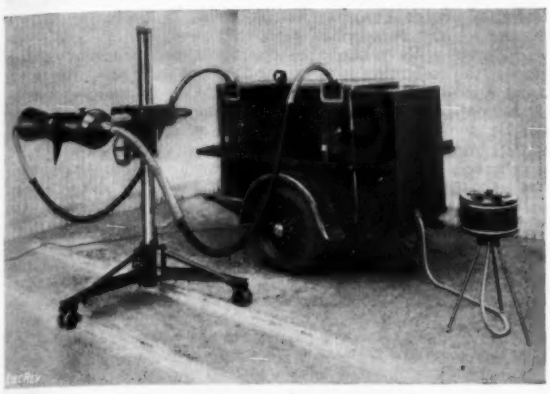
In addition, the Soviet Government has sanctioned a building for a new electro-technical combine near Sverdlovsk (Ural), work on which will commence this year. These works will consist of the following sections:—Turbo-generator sets, (annual output 2,500,000 kW); electrical machinery (4,200 million roubles); transformers (360 million roubles); switchgear and apparatus (595 million roubles); and cables (600 million roubles).

The works will employ 124,000 people, including 12,000 senior technical personnel. A new town for 300,000 inhabitants will be built to house the employés. The houses and buildings will be heated from the power station. The estimated cost of this undertaking is 700 million roubles.

Ambitious as the first Five Year Plan was, the electrical industry fulfilled its full programme in 3¼ years. Particulars have now appeared of the second Five Year Plan, which appears to be even more ambitious in its scope, and which will eventually place the U.S.S.R. among the foremost industrial countries of the world.

The Detection of Faulty Welds

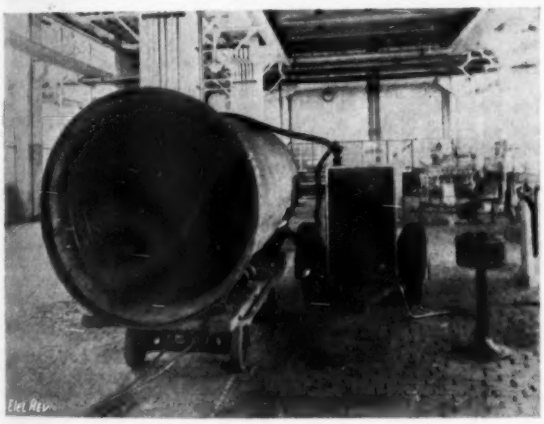
FROM being used almost exclusively for the diagnosis and treatment of bodily ailments, X-rays have been employed more recently for scientific purposes and, to a certain limited extent, in industry. Apparatus has now been developed, however, which may eventually lead to the adoption



The " Metalix " industrial unit

of X-rays as a standard method of testing in many branches of the engineering industry. A mobile plant recently installed by Babcock & Wilcox, Ltd., of Renfrew, produces rays which will penetrate heavy steel and can be used in the workshop without any difficulty, or danger, to the operator.

Principally, the apparatus will be used for testing welded joints, for which purpose it is a practicable, non-destructive method. Bonding errors, gas bubbles, slag inclusions, shrinkage cracks, and other faults can be detected and located by this method. Of the many attempts made in the past to devise satisfactory means of examining welds (acoustic, electrical, magnetic, radium, &c.) it is generally accepted that X-rays are the most facile. In this new apparatus difficulties formerly associated with the use of radiology for such purposes have been overcome.



Inspecting the cross tube of a firebox shell. (The " Metalix " tube is inserted in the cross tube)

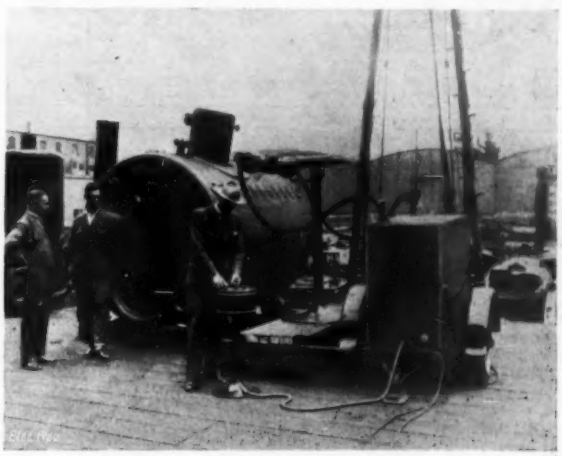
Protective Measures

The apparatus is manufactured by Philips Lamps, Ltd., who claim that their " Metalix " self-protective X-ray tube has banished the danger of unwanted radiation in medical X-ray work. Briefly, it consists of an X-ray tube of heavy-loaded capacity, a high-voltage generator, and the necessary stand, controls, &c. The most outstanding feature of the equipment is its entirely shockproof construction and complete protection against unwanted radiation. The complete electrical safety has rendered possible many operations hitherto beyond the reach of X-ray examinations.

The most interesting feature from the electrical engineer's point of view is the shockproof nature of the unit. The insulation of each cable has to withstand a pressure of approximately 100 kV; moreover, in the anode cable itself there are two concentric ducts through which cooling water is forced by a pressure pump. Each cable is sheathed on its exterior surface by an earthed metallic braiding. The high-voltage protection, therefore, does not depend on insulation alone. In the event of a breakdown of one cable, for instance, there is a direct return circuit to earth, so that even if the operator is grasping the exterior of the X-ray tube, or the cables, when a defect due to breakdown of the insulation arises, no shock, or even unpleasant sensation, will be experienced.

Method of Testing

If it is required to assess the quality of a boiler weld the engineer brings the X-ray unit close to the boiler and directs the aperture of the tube at a section of the weld. A special photographic film, contained in a light-proof metal " cassette,"



Radiographic examination of a boiler at a quayside

is held against the inside of the weld and voltage is applied to the tube. After the elapse of some seconds, dependent on the thickness of the metal, the film is developed and the resultant radiograph will reveal any hidden defects. The whole length of the weld is treated in this way, although the films, of course, will be developed together to save time.

In certain cases, when it is not required to make radiographs, a visual method of X-ray examination may be employed. In this case the operator makes use of a sheet of lead-glass, coated with a material which fluoresces when subjected to X-rays. After passing through the weld a shadow

Radiograph of a ¾-in. thick boiler weld

is cast on this fluorescent screen on which any differences in the thickness of the metal will be discernible.

As will be noted from the accompanying illustrations, the entire unit is mounted on a mobile trolley, which can be trailed behind a car or lorry, a feature of great utility when scattered, or branch, works are involved.

Modern Theatre Lighting

THE modern theatre is becoming more and more dependent upon electric light, and the staging of such a production as *The Miracle*, which opened under Professor Max Reinhardt's direction at the Lyceum Theatre, London, on Saturday last, would be almost impossible without it. For the purposes of this spectacular play the interior of the theatre has been converted into an abbey, the stage being built out into the auditorium, with a crypt beneath the stage.

The lighting arrangements have been entirely reorganised by the Strand Electric and Engineering Co., Ltd., and a special 80-way switch and dimmer board have been installed. In place of the usual stage batons there are 48 arena type lanterns containing 1,000-W lamps, while the space occupied by No. 1 baton contains an additional twelve spotlights. From the perches are directed six 2,000-W spotlights in specially designed lanterns, thirteen similar lanterns projecting from the boxes and gallery front.

Spotlights are also arranged in front of the proscenium, as well as on the circle front in housings specially designed to fit in with the general decoration scheme. Arc lights have been placed in the flies and on the gallery fronts. In one case where access is difficult the lamps have been wired in triplicate with relays to guard against failures.

The lighting in the auditorium provides sunlight and stained-glass window effects upon the columns and arches. On the stage in the cathedral scenes the illumination of large masses of " stonework " has been very successfully accomplished.

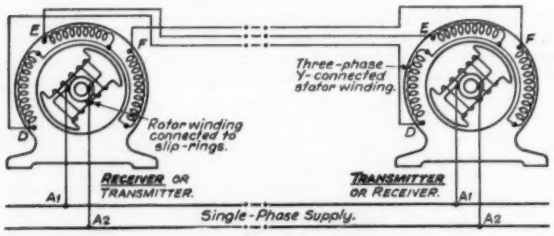
For the general lighting " Osram " lamps are employed, a number of " B.E.L.L." lamps being used for torch and candle fittings. The wiring is of Pirelli-General manufacture.

Remote Indication and Control

Applications of the "Selsyn" system

WHERE motion is to be reproduced at some remote point or mechanism is to be moved by an amount proportional to the difference between the motions of two other mechanisms the " Selsyn " provides a simple and reliable coupling.

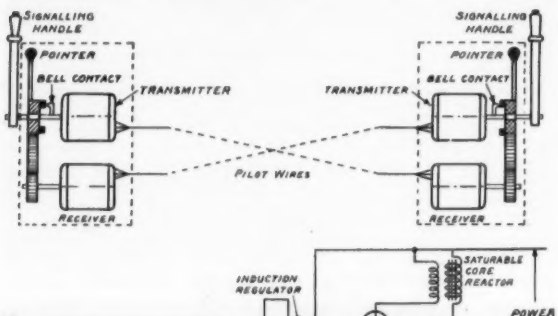
The Selsyn unit consists of a small electrical machine having a three-phase stator winding in slots and a single-phase salient-pole rotor. Generally there are two poles giving only one



Connections for transmitter and receiver

position of correspondence per 360 deg. of movement. The two units employed at opposite ends of the system have their stators connected through three pilot wires; their rotors are connected to the same single-phase supply.

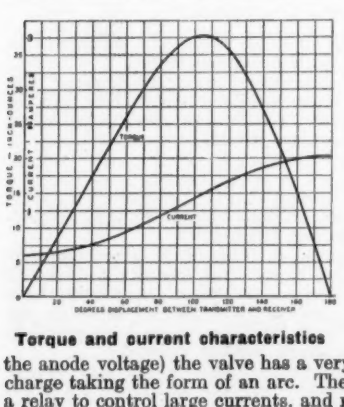
When the units are in the same position relative to each other, the e.m.f.s induced in the stator windings oppose one another and no stator current flows. Any relative displacement causes circulating currents in the stators giving restoring torques roughly proportional to the sine of the angle of error. The unit is self setting, if the complete travel is less than 360 deg., and one transmitter can send different signals to



(Above) The Selsyn system for engine-room telegraphs (Below) Arrangements with thyratron valves

several receivers which will automatically set themselves into coincidence with the transmitter on the operation of a selector switch. Oscillations are damped by a small flywheel which can rotate on the shaft but which is checked by a light friction disc.

Among the numerous actual and possible applications of the Selsyn system are the distant indication of water levels, the operation of power station telegraphs and the control of valves from a central point (especially in such industries as oil refining and chemical works).



Torque and current characteristics

Large amounts of energy may be remote controlled by the use of thyratrons (mercury-vapour valves having a heated cathode surrounded by a grid and an anode) in conjunction with saturable core reactors. A negative voltage of sufficient value on the grid will prevent current flowing, but at certain smaller negative values (depending on the anode voltage) the valve has a very low resistance, the discharge taking the form of an arc. The thyratron thus becomes a relay to control large currents, and requires negligible power for its operation.

There is a field for this application in theatre lighting, and in the starting of large machines; where the operated device demands considerable torque. This may be provided by an auxiliary motor, the Selsyn being fitted with contacts as a motor-control switch. If the friction of the contacts is undesirable or the currents too large (as in rolling mills) the thyratron may be used as a relay.

In large mills where the metal is subjected to several passes, the reduction between rolls after each pass can be set in advance to a predetermined schedule by means of a Selsyn-thyratron equipment, the operator having only to move a master switch one notch per pass, when the rolls will be adjusted rapidly. At the end of the series the master switch is returned to the first notch, and the rolls automatically open out to the initial position of the next billet. The use of two pairs of Selsyns, a coarse and a vernier, one for each pass, secures close accuracy.

The system can be adapted to many other duties by the use of a " differential Selsyn," whose rotor has a three-phase winding in slots. If one of three units is inserted as a transformer in the stator circuits of the two main Selsyns (*i.e.*, the stator and rotor winding of the differential unit are used as primary and secondary windings, respectively) and the differential unit is prevented from rotating, the main units may have a relative displacement when in the no-torque position, depending upon the angular position of the differential unit.

If one of the three units is free to rotate while the other two are coupled to two different mechanisms the free unit

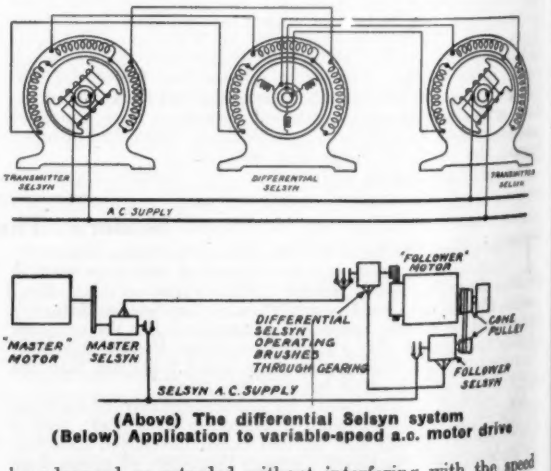
Component parts of transmitter

will move by an amount depending on the algebraic sum of the movements of the other two. Thus, if two are coupled to float mechanisms measuring the heights of water in two reservoirs, the third could indicate the difference between the two.

When a number of differential units are connected between two ordinary Selsyns and all, except one, coupled to indicating or measuring instruments, the remaining unit can show the sum of the readings of the others or the difference between one or more and the sum of the others. The system can add both positive and negative values with due regard to their sense.

If two units of a three-unit system are coupled to two moving mechanisms whose relative speeds differ, the third Selsyn will revolve at a speed corresponding to the difference between the first two, and may be coupled to a device to equalise the speeds. Thus in a paper mill, where separately driven units are required to run at proportional speeds, varying the speed between any motor and its Selsyn (*e.g.*, by conical belt pulleys) its speed can be altered but will still follow proportionally variations in the speed of the master motor.

Further, by the insertion of a fourth Selsyn of a differential type into the system, the phase of rotation of any motor can



(Above) The differential Selsyn system (Below) Application to variable-speed a.c. motor drive

be advanced or retarded without interfering with the speed proportionality. Selsyns are manufactured in this country by the British Thomson-Houston Co., Ltd.

A Village Supply Scheme

How a new pumping system made electricity available

THE village of Ashmansworth, lying about midway between Newbury and Andover and between 700 and 800 ft. above sea level on the North Hampshire Hills, until recently depended upon rainfall for its water supply, a serious matter for its inhabitants in dry seasons. To cart water sufficient for a dairy herd during a normal summer cost no less than £100.

After somewhat prolonged negotiations resulting from an application by Mr. H. C. G. Ellis-Fermer, the principal landowner, for assistance in obtaining an adequate water supply, a grant of half of the cost was made by the Ministry of Agriculture, with the stipulation that the work was to be carried out under the supervision and to the approval of the Lands Officer of the Hampshire County Council.

It was decided to bore at a spot about a mile south-west of the village and on the 600-ft. contour line, and water was first encountered 270 ft. down, but as soon as the depth of the bore increased to 350 ft. the water rose to within 249 ft. of the surface. To ensure ample supply in dry seasons the bore was carried down to 385 ft.

Test results proved the supply adequate and potable. The bore hole was then lined for 297 ft. from the surface to exclude any possibility of infiltration by surface water, and the remainder of the scheme put in hand.

A 20,000-gal. cast-iron storage tank has been erected on a steel-framed tower 50 ft. above ground level, so that an ample head of water is available at any house in the village.

The pump house is situated over the bore hole, provision being made for the withdrawal of the pump and pump rods, when required, by a deep pit inside the house, without structural disturbance. Lifting appliances are provided, so that replacement can be effected within eight hours.

The bore-hole pump delivers into a tank holding 1,000 gallons, placed in the pump house, and a three-throw ram pump takes its supply from this and forces the water up to the reservoir, the pressure necessary being 125 lbs.

A 12-h.p. B.T.-H. motor with a Brookhirst starter drives both the bore-hole and the ram pumps, and is connected by a Wellman-Bibby flexible coupling to a line shaft on which are the belt pulleys, transmitting power to the pumps. The motor runs at 475 r.p.m. and drives through machine-cut spur reduction gears running in oil baths. A three-phase supply at 400 V is received from a power line of the Wessex Electricity Supply Co. half a mile away.

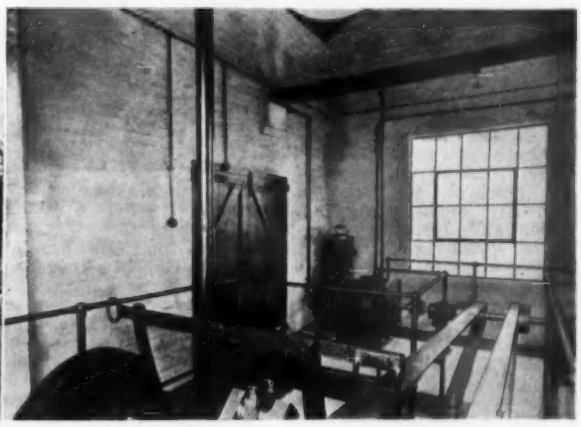
To obtain current at the cheapest rates the machinery is only run during the "off-peak" hours, a time switch automatically cutting off the current between 4.30 p.m. and 7 a.m.

The scheme is undoubtedly a boon to the village, for not only is water available to all, but the arrangement for conveying electricity to the pumping plant brought electric lighting into being, an auxiliary main at 230 V having been erected through the village, and the majority of the houses, to say nothing of the church, the chapel, and the village inn, are now connected.

The contractors for the scheme were Messrs. Ockenden and Smith, of Basingstoke, who carried out the work under the direction of Mr. C. F. B. Marshall, M.I.Mech.E., A.M.I.E.E., acting for the consulting engineer, Mr. Leslie N. Burt, M.I.Mech.E.

Each house is charged for lighting at £3 per year for up to 280 kWh, after which consumption 9½d. per kWh is charged, and in each installation three lighting points are provided free, complete with lamps, &c. Larger consumers are supplied throughout on flat-rate bases of 9½d. and 2½d. per kWh for lighting and power, respectively.

Pump house



Driving motor in pump house

Light as a Decorative Medium

Successful applications at Messrs. Lilley & Skinner's new premises

MODERN lighting as an effective method of shop decoration is admirably demonstrated in the new extension of Messrs. Lilley & Skinner's shoe "emporium" in Oxford Street, W., pictures of which appear on page 553. Except for a few mural paintings on the first floor, the decorative effects are attained solely by means of various types of artistic lighting in conjunction with the graceful yet plain design of the polished panelling, which adorns the walls, pillars and staircases.

The main illumination of the ground floor, which is used almost entirely as a showroom, is obtained partly by large pendant fittings and partly by a novel form of ceiling box lights. Four large columns, in addition to incorporating a number of small showcases, provide accommodation in one case for the cashier's desk and in the remainder for cupboards, switches, telephones, vacuum cleaning plant, and conveyor lifts communicating with the stock room and the packing and despatching room.

Near the top of these columns and partly encircling them have been installed some attractive three-tiered light fittings which show to advantage the veneered woodwork. At the far end of the new building and facing the Stratford Place entrance is an illuminated glass fountain in which some very pleasing effects are obtained by a revolving colour lighting device.

Round the walls at intervals are shelves for the shoe boxes extending from floor to ceiling, a number of galleries being provided to take full advantage of the height of the showroom.

A feature of these galleries is the glass floor panels which make it possible to illuminate both the galleries themselves and the service rooms below, as well as the showcases let into the walls. A scheme of lighting and mirrors in the fitting rooms enables customers to see their footware at all angles and to the best advantage.

As a decoration from the staircase leading to an annexe showroom an illuminated coloured bowl has been installed, and spot lights have been placed at various vantage points to attract attention to special lines of goods displayed on show tables.

Further fitting and store rooms are on the first floor, and here, too, there are round the walls a number of small showcases fitted with "Duray" reflectors. The display windows facing Oxford Street have also been completely reconditioned, and an excellent effect is obtained by the inclusion in the base of the showcases of frosted glass panels illuminated from behind.

Floodlighting of the top storey of the building is provided by means of "Holophane" reflectors, neon lighting also being used in the illumination of the front of the stores.

The electrical installation work was carried out by Messrs. W. A. Hole, the lighting fittings being supplied by Messrs. Osler & Faraday. "Walsall" conduit was employed for the wiring and "Wandsworth" switches were used. The lamps are "Osram" and "Philips." "Strowger" automatic telephones and "Sychronome" electric clocks have been installed throughout the building.

Superconductivity. By A. Page, B.Sc., A.M.I.E.E.

The relationships of electricity, magnetism, and light

THERE have been quite a number of comments recently on the subject of superconductivity and its possibilities, so that no excuse is necessary for reviewing the subject from a new standpoint. So far suggestions have been confined to the more orthodox method of producing superconductivity, namely, by subjecting a conductor to intense cold whereby the natural decrement of resistance with reduced temperature is carried to the extreme limit.

Resistance may, however, be looked upon as an evil which we ourselves have created through our ignorance of the fundamentals of electricity. In a simple electrical circuit developing no work there should be no conversion of energy. In other words, the potential (in its physical meaning) of the electrical energy is not altered, but is merely transferred from one point to another *via* the interconnector. That we have fortunately discovered how electricity can be directed and transferred, even although inefficiently, is a most important factor. Without this discovery the practical importance of electricity might have vanished, and certainly super-power stations could not possibly have come into being.

Mr. A. Page is a member of the staff of Landis & Gyr, Ltd.

What would be the result if light could be similarly directed? Would we then have illumination generating stations with an independent network to our electrical supplies? It seems not unreasonable to anticipate such a development, as electricity and light are allied phenomena with many characteristics in common. The transmission of light from one point to another at 100 per cent. efficiency is looked on as a matter of course, but a similar transmission of electricity would be considered abnormal.

Evidently there appears to be something in the nature of light which is lacking in our electrical systems, giving rise to the inefficient application of electricity as we now know it. The simile, however, need not be confined to the comparison of light with electricity, since radiant heat, cosmic radiations, &c., fall into the same category.

The Nature of Resistance

The indications are that resistance is a result of contact with matter, and it may be a definitely fixed quantity for all materials, or proportional to their molecular construction, but artificially masked to us at present by other causes. Knowing that ether permeates all matter, we cannot reasonably measure the specific resistance of a material before we isolate the ether in the material from the material proper. Otherwise the figure obtained would be the resultant of the current meeting high resistance passing through the material, and the current meeting low resistance passing through the ether in the material.

Our present figures of specific resistance show us only the relationship of the ether to the material in the body under examination. Figuratively, we could say that if an electrical current were of such a " nature " as to fill, in traversing, all the interstices of the material caused or filled by ether then we would have no resistance. The resistance which is exhibited is an indication of the unsuitability of the electricity passing for the available interstices, and the overlap constitutes a drag on the non-superconductive material. (The foregoing is, of course, only a figure of speech, but it nevertheless gives a convenient mental picture.)

The interstices must in some manner be so influenced by temperature that they become more accommodative to the " type " of electrical energy which we now employ, but we should equally well be able to make the " type " of electrical energy accommodative to the ether available in and around our conductors. The word " type " is used to imply something which is as yet unknown, but which may highly be probable.

In this respect let us consider the relationship between magnetism and electricity. If we circulate an electrical current a magnetic field is created in the immediate nighbourhood. Conversely, as Faraday proved, a magnetic field can be utilised to generate electricity. In other words, the one may be looked on as the reflex of the other. Neither the material of the conductor nor of the surrounding space enters into the question.

What is Magnetism?

Viewed in this light, it becomes interesting to speculate whether the rule holds invariably that magnetism is an outward indication of the presence of electrical currents. For instance, we have in the case of a permanent magnet a source of magnetism without any apparent electrical current. We can hardly conceive an electrical current which would not give rise to a magnetic field, so the question arises: Is not a piece of iron exhibiting the properties of a magnet really in this state due to circulating electrical currents rather than to the fact that it is ferrous?

After all, magnetism is not a peculiar property of iron, as it can equally well be made manifest in a piece of copper, provided the copper has a current of electricity flowing through it. Rather we should consider ferrous materials as having the peculiar property that they can readily be so influenced as to cause internal currents to circulate (in a permanent magnet, indefinitely), whereby we have an outward manifestation of magnetism.

Whether the currents are large or small is difficult to state, but their complete paths are probably of molecular dimensions. Most probably the currents are infinitesimal, but what they lack in strength they make up in number, and as their directions are mainly opposed we are outwardly only aware of differences.

Our orthodox explanation that magnetism is due to the molecules so arranging themselves that the north comes to the south pole, and so on, is extremely feeble, as we should then ask ourselves why should a ferrous molecule have a north and a south pole any more than a molecule of copper? Can it be that in a permanent magnet there are electrical currents of such a nature that they flow indefinitely and with undiminishing strength—a practical example of superconductivity?

"Sunbeam" Trolley Buses

THE first six-wheel electric trolley bus built by the Sunbeam Motor Car Co., Ltd., has now been in constant service on an arduous route in Wolverhampton for nearly twelve months, and has given great satisfaction. A further order for a modified type of vehicle has just been placed with the company by the Wolverhampton Corporation.

Broadly speaking, the main alteration concerns the power unit, which is of the regenerative type, an interesting feature being that the minimum road speed when regeneration takes place has been reduced to 10 m.p.h. Besides the introduction of the regenerative motor, several other chassis details, including transmission, the control, and the method of wiring, have been improved.

The chassis has a wheelbase of 17 ft. (measured from the front axle to the centre of the rear bogie) and a track of 6 ft. 2⅛ in. (rear), and it is intended for the largest type of double-deck coachwork. The after portion of the frame (behind the third axle) has been swept down to provide a platform height (laden) of but 1 ft., whilst the main part of the frame is 2 ft. 1 in. high. The complete weight of the chassis is 4.41 tons, and despite an overall length of 27 ft. 5½ in., a turning circle of under 60 ft. has been made possible.

The 500-V d.c. motor, designed and manufactured by the Metropolitan-Vickers Electrical Co., Ltd., is mounted amidships on a rigid sub-frame and is rated at 70 h.p. It is of the compound-wound type, and allowance has been made for heavy overloads.

Chief interest in the new chassis concerns the controller, which is of a new type produced jointly by the B.T.-H. and Metropolitan-Vickers concerns. An accelerator pedal of the plate type is mounted in such a position that it is conveniently placed for operation by the driver's right foot. Through a system of links, a scissors type of main controller is operated, the contacts being so arranged that the accelerative powers of the vehicle are definitely proportional to the amount that the pedal is depressed.

The controller switch is interlocked with a reverse, neutral, and forward switch fitted on the dashboard; it is actuated by the driver's left hand, and ensures that the pedal is in the " off " position before the driver can alter the directional switch. The pedal-operated controller switch does not carry the main current; the contactors operate solenoids on the main contactor panel.

The shunt-contactor panel is the first of a new type and is carried on the near side of the front panel of the cab. Each contactor has a suitable resistance, wired in series, which prevents arcing on the contacts. Furthermore, a coil is used to cut out the line circuit when a trolley pole leaves the overhead wire and the vehicle is in motion, thereby preventing a burn-out of the lamps. The circuit is brought back to normal by pressing a button mounted in an accessible position on the front dash panel.

Resistances are mounted on each side of the main frame, the series component being on the near side and the shunt one on the off side. Care has been taken to ensure that the heated elements are properly ventilated. The resistances are wire-bound, rustless, jointless, and are claimed to be unbreakable. All the wiring for the control gear is contained in flexible-steel tubes and all internal wiring is carried out in cab-tyre sheathed flex. The connections running from the motor are contained in a split-oak cleat suspended from the sub-frame.

Hydraulic and hand braking are provided. The new chassis are at present being equipped with bodies at the works of Weymann's Motor Bodies, Ltd., Weybridge.

Illustrations of the " Sunbeam " vehicles are reproduced on the opposite page.

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

How Electricity Supply Costs are Analysed

IN the paper which Major E. H. E. Woodward and Mr. W. A. Carne read before the Institution of Electrical Engineers yesterday (Thursday) the authors aim at outlining a system of analysis of the costs of electricity supply which is suitable for use by a large undertaking giving supplies under very varied conditions to consumers of many different types.

The system described has been evolved during the past eight years by the Newcastle-upon-Tyne Electric Supply Co., Ltd., and its subsidiaries. Six pages are devoted to the explanation of the method (appendices occupying 37 pages) which consists in (1) The division of annual costs and of capital expenditure under a sufficient number of suitable headings, and the allocation of the item under each heading as a fixed charge or running cost; or its further division so as to allocate part as a fixed charge and part as a running cost.

(2) The division of consumers into three main groups in accordance with the general conditions under which they take supplies and the allocation of the costs and capital expenditure divided as above between these groups.

(3) The analysis of the costs and capital expenditure allocated to each group, and the evolution of formulæ suitable for application to individual members of each group.

Sunbeam trolley buses *(see opposite page)*: **(Left) One of the Wolverhampton vehicles; (right) the new chassis**

Scope of "Overhead Costs"

It will be noted that capital is dealt with by the allocation of the amount of capital expenditure instead of by the more usual method of treating capital charges as an item of overhead expenses. The expression "overhead costs" used in the paper is exclusive of capital charges. The method adopted has been found more convenient in practice, as the figures obtained by it have a wider application of use than figures involving the assumption of rates of interest and depreciation.

Some views on tariffs rather contrary to those frequently accepted arise from a study on these lines. One of these is that it is not correct to assume that the unit charge in a two-part tariff suitable for domestic supplies will be correct for other supplies, such as, say, those to shops. This is because it is not suitable in practice to make the unit charge as low as the theoretical cost varying with units, as to do so would not only make the price to short-hour users higher than is practicable, but would be inequitable unless the factor governing the fixed portion of the charge was one which took proper account of diversity.

As such factors are not available, it is more correct, as is customary, to make the unit charge greater than its theoretical value, so that it will cover part of the cost depending on demand and to reduce the fixed part of the charge correspondingly. By choosing a suitable increase to the unit charge a reasonable corrective for the effect of varying diversity can be automatically obtained for a particular class of consumer, but the amount of increase so required varies with different classes.

Domestic Supply Tariffs

Another point is that for domestic supplies a two-part tariff consisting of a fixed charge (calculated on floor area, number of rooms, rateable value or some such factor) and a single charge per unit only gives a good representation of cost over very limited ranges of consumption, and such a tariff can be much improved by the substitution of a sliding-scale unit rate for the single-unit charge, the steps of the scale being governed by the same factor as that which operates in the case of the fixed charge.

Again, in the case of small power supplies from low-voltage networks it will appear from a study of cost analysis that a simple sliding scale unit tariff is probably more correct from a cost point of view than any two-part tariff in which one of the charges is based on demand, kilowatts connected, rateable value, or some such factor.

Aluminium or Copper?

THE bare cost of the conductors may amount to a large proportion of the total cost of an overhead line: up to 35 per cent. in the case of a single-circuit line and up to 45 per cent. in that of a double-circuit line. In view of their importance, it is surprising to find that they are, in most cases, the weakest portion of the whole transmission line. Very little serious thought has been given to their design, and there is no doubt whatever that they, as a whole, are by far the poorest job from an engineering point of view.

Such are the opinions expressed by Mr. C. Featherstone Coles in a paper which he read before the London branch of the Association of Mining Electrical Engineers last week. This is regrettable, for he maintains that for little extra outlay the conductors could be made much sounder in construction to afford a considerably increased factor of safety of the overhead line as a whole.

Aluminium Conductors

Copper is the best known conductor material, but overproduction has reduced the advantages of its recognised price, open market, and scrap value.

Aluminium is rapidly taking its place. It is only 30 per cent. the weight of copper, while its conductivity is approximately 61 per cent. of that of annealed copper. Therefore for equal conductivity its weight is approximately 48 per cent. that of copper. The purity of aluminium used for electrical conductors to-day is at least 99.5 per cent., and the fact that the price of the raw material is controlled enables a fairly accurate estimate to be made of the scrap value over a fairly long period, whereas the copper market fluctuates over such a wide range that the scrap value of copper cannot be accurately estimated.

The chief reason, perhaps, why steel wire is not more commonly used is because the deterioration of the wire places too much work upon the maintenance department. Steel wire, however, finds a very welcome place in combination with copper and aluminium, and the economies which can be effected by the combination of these metals are in some instances astounding.

"Tru-lay" Stranding

A recent development is the "Tru-lay" process of stranding. The wires, before they are closed in the helix, are definitely shaped into a similar helix to that which they will eventually take up in the strand, and by this method all the initial stresses are taken out of the conductor and there is no tendency for the wires to spring back into their straight position. This means that the completed strands are "dead," and do not have a tendency to take up any other position than that into which they are placed.

This has many advantages, one of the chief of which is that when the conductor is cut the wires do not all fly apart, facilitating jointing and making-off, and preventing any undue stress being placed on the individual wires due to their "liveliness." Another advantage is that the wires do not need to have the same strain placed upon them while stranding in order to keep them down into their place, and it ensures that every wire is in its proper place in the strand and, therefore, that the stresses on the wires will be much more uniform.

Tests and Clamps

The elongation test is not satisfactory unless made with a machine that will automatically record graphically. As a means of comparison with accepted standards, the torsion test can be relied upon. In the case of galvanised steel wire, insistence on a wrapping test often results in an inferior article being supplied, because a thin layer of zinc that will not crack may be less acceptable than a thick layer which may crack.

The bolted clamp lends itself readily to erection by inex-

perienced and casual labour, but its other advantages are few and it is to a large extent responsible for the lower breaking loads upon which the majority of engineers have to base their designs. The extra cost involved in erecting lines to the present B.E.S.A. breaking load figures, compared to those breaking loads which are possible with exactly the same conductors and the same factors of safety, would pay for the difference between the prices of a bolted and a cone type clamp many times over.

As an instance of this, the 0.175 sq. in. steel-cored aluminium conductor is rated in the British Standard Specification at 17,700 lb., and this conductor used with a bolted clamp has a maximum breaking load of 16,800 lb., thereby forcing the use of a maximum working tension of 8,400 lb.; whereas with the cone type clamp a breaking load of 18,500 lb. can easily be guaranteed. This would mean that the maximum working tension of this conductor could be readily increased from 8,400 to 9,250 lb., still maintaining the same factor of safety.

The advantage of the cone type clamp is its compactness, lightness and efficiency. It is made in several different designs, but in every case the main feature is that the steel core is held separately from the aluminium or copper strands. Its ability to withstand the vibrations of the conductor to a considerably greater extent than any other type of clamp, without causing a fracture in the conductor itself, is partly due to the fact that the stress is more evenly distributed between the steel and the aluminium.

Experiments made by British Ropes, Ltd., have proved conclusively, according to the author, that failure due to vibration is more dependent upon the type of clamp than anything else.

Discussion

Mr. H. M. Morgans pointed out that if the clamp were not situated just at the node of the vibrating conductor it would vibrate.

Mr. J. W. Macdonald suggested that it might be advisable to provide for the whole of the strain to be taken by the steel core, leaving the copper or aluminium as some form of gland which would be free to move in accordance with varying ratios of expansion due to temperature differences, thus avoiding any strain on the copper or aluminium conductor.

Mr. A. F. W. Richards asked if segmental conductors were in general use, or only in special cases such as at the Menai Straits and for very long spans. The author had not mentioned the limit of proportionality, the yield point, or elastic limit.

If a conductor was tested the aluminium wires would always break first, and then the application of the load had to be continued until the steel wire had been stretched a further two or three per cent., when that also would break. One did not increase the load, of course. Did that difference give rise to trouble in practice, because it was possible that a heavy load on a conductor would stress the aluminium beyond the elastic limit and break it, whereas the steel, by reason of its greater elongation, would remain intact.

He was not quite convinced that the wrapping test was useless. Torsional joints were very largely used and their makers claimed 100 per cent. of the aggregate breaking load; he believed they could attain that.

The Author's Reply

Mr. Featherstone Coles, replying to the discussion, said there were very few big grid lines to-day on which bolted clamps were used, although they were still being used on some of the small lines. In most composite conductors the actual conducting material represented quite a large proportion of the breaking load of the total strand. In a 30-wire construction it would be about 50 per cent. on the aluminium and about 50 per cent. on the steel.

To-day the price of aluminium was about £95 per ton, and the scrap value about £80; the price of copper was about £40 per ton, and the scrap value about £32. The segmental conductor was in general use; there were between 1,500 and 2,000 miles of it in all classes of material—steel-cored copper, steel-cored aluminium, and copper-cored steel.

Aluminium had an elongation of about 2 per cent. and the steel used in conjunction with it about 4 per cent., but the conductors were never strained to anything like their ultimate load. There would be a factor of safety of two on ordinary overhead lines, based on the maximum breaking load.

It was not his intention to state that wrapping tests were of no use. What he had wished to imply was that condemnation of wires simply because the zinc had cracked was definitely wrong; only the outer layer of zinc cracked, not the amalgam of zinc and steel, and it was that which gave the definite protection.

Checking Telephone Transmission

SOME of the work carried out in the research section of the General Post Office is described in the paper which Mr. H. R. Harbottle read before the Wireless Section of the Institution of Electrical Engineers on April 8th. An attempt is made to indicate the progress of telephonic instrument measurement standardisation, a subject with many pitfalls.

Part 1 of the paper is devoted to electro-acoustic and acousto-electric measurements of instruments. In Part 2 various voice-ear measurements on microphones and receivers are described. Part 3 deals with some mechanical tests by means of which rapid acceptance tests and estimates of the commercial life of instruments can be made. The measurement of the efficiency of apparatus and circuits in actual use is discussed in Part 4.

Testing Subscribers' Transmission

In certain districts it is now possible to make routine measurements of a subscriber's transmission at his exchange. The instrument used is essentially a valve voltmeter. The rectifier is similar to the one employed in the speech meter, with the exception that the grid leak is connected to the filament of the valve *via* a relay contact. This relay is very sensitive and is operated by means of an amplifier rectifier from the actual speech currents.

Thus, the recording instrument measures the subscriber's volume and its reading is quite steady, since, during an interval, the grid of the rectifying valve remains insulated, and the condenser remains charged to its previous value. If complaints are received of poor transmission or if abnormal transmission is noted in these routine tests, the overall transmission of the circuit is tested as follows:—

A lineman takes a previously calibrated carbon microphone to the subscriber's premises. This is connected across the line with the receiver of the ordinary instrument still on the switch hook, *i.e.*, the 1,000-ohm bell and 2 mF condenser form the only shunt across the microphone. The lineman then counts "1, 2, 3, 4, 5" into the calibrated microphone at his normal volume-level. The reading obtained on the valve voltmeter at the exchange is noted. Then, having disconnected the calibrated microphone and removed the receiver from its switch hook, the lineman speaks in the same manner into the subscriber's microphone and the reading on the exchange instrument is again noted.

If the loop resistance of the subscriber's line is known, the feeding current to the calibrated microphone can be calculated and its efficiency, when used in the above condition, estimated. Thus any fault in a subscriber's microphone can be discovered and rectified.

A similar measurement has also been used for determining the efficiency of subscribers' receivers *in situ*, but since very little trouble is experienced in this connection it has now been discontinued. An endeavour is at present being made to replace the voice in these tests by a standard noise produced by simple mechanical means.

Volume and Intelligibility

This test takes no account of the articulation efficiency, and therefore the intelligibility of the circuit, and it is possible that in certain cases the volume efficiency of a circuit may be normal and yet the circuit may not be commercial. Although the performance of the various instruments, circuits, &c., can be estimated from the measurements previously described in the paper, it is thought that a further means of finding their commercial efficiency when in actual use should be obtained. A method of ascertaining this efficiency is shortly to be put in hand, and series of tests will be made on selected circuits over a period of about three years.

Quality and Quantity in Communications

DR. F. LUSCHEN travelled from Germany to read his paper, "Modern Communication Systems" (referred to last week), at the Institution of Electrical Engineers on April 7th. The effects of non-linear attenuation, echo, phase compensation, &c., on long-distance cable telephony were demonstrated by means of gramophone reproduction.

Col. Sir T. F. Purves opened the discussion by referring to the author's work on the C.C.I. His command of the German, French, and English languages had been invaluable and he had an unerring eye for vital essentials. When he left the German Post Office to join Messrs. Siemens and Halske a special statute was passed to enable him to continue to serve on the C.C.I.

Sir Thomas had considerable sympathy with the author's suggestion that the C.C.I. should in future concentrate on specifying the electrical characteristics of lines and leave their actual make-up to the individual administrations concerned. Originally those specifications were framed because the smaller countries had no means of drawing up their own, but now the tendency was to recast them merely from the performance point of view.

Television Neglected

Mr. A. B. Hart compared modern achievements with those of twenty years ago. In 1924 it was thought that cable telephony could not proceed for more than 300 miles. Some of the difficulties, such as echo and phase distortion, which had been foreseen then had been lucidly explained away by the author. He was disappointed that television was not mentioned in the paper.

Mr. H. H. Harrison described the paper as a picture of the mechanism of signal formation. The cost of two-band telephony would need careful study. Start-stop telegraph apparatus on really long links might itself introduce distortion, apart from that which occurred in the cable or wireless link, so a return might have to be made to the oriented cam arrangement.

Mr. G. C. Harris thought that complication of apparatus was increasing at a faster rate than the number of subscribers. The author's table of values of the constant k (= frequency band width × transmission time) for various means of transmission was open to a misleading interpretation, so that the factor k could not be a measure of the line quality. For instance, one might invent a special telephone language for a particular frequency band.

Capt. J. G. Hines predicted that ultimately the hand-'phone receiver would be displaced by the loud-speaker. The desire was to press a button and converse as naturally as possible, at any rate for office work. But for equal intelligibility loud-speaker reproduction demanded the transmission of a wider frequency band than hand-'phones did. Therefore they must not "pinch" the unwanted portions too much now as they might be needed later. The G.P.O. was doing its utmost to make its circuits carry the maximum number of communication channels.

Cable Maintenance

Mr. H. T. Werren, speaking as a cable engineer, said that every advance in the art of communication imposed greater burdens on the cable maker. Multiplexing increased the importance of cable maintenance, so that the G.P.O. practice of putting physical circuits in place of phantoms was the correct course.

Capt. A. C. Timmis was of the opinion that relative costs indicated that two-band telephony was more suitable for long loaded cables. He described the improvement that accrued from stabilisation, which cut off nothing but automatically reduced amplification when no speech was passing.

Dr. A. Rosen described the characteristics of the new Anglo-Belgian cable which was being made for the G.P.O., and exhibited a sample of it, which showed it to be composed of short intermittent loaded and plain sections. He thought that that method of construction had possibilities for land as well as submarine work. Col. A. S. Angwin suggested that the relative power absorbed by telephony and telegraphy on a multiplexed link was an economic aspect which needed some consideration.

Covering a ceiling with the new "Dulrae" fabric which contains thin wires and is used to give evenly distributed heat throughout a room

Author's Tribute to British Engineers

The author, in reply, remarked that the present state of perfection of world-wide telephony was the result of international co-operation, under the stimulus and leadership of British engineers, with which he associated the names of Mr. Frank Gill and Sir Thomas Purves. He regarded television sceptically—no one would make any money out of it.

Where Electrical Ship Propulsion Scores

So many variables affect the choice of ships' propelling machinery that each case must be considered on its merits. The paper which Mr. J. Turner read before the London Students' Section of the Institution of Electrical Engineers on April 12th shows that with Diesel-electric plant reliability is obtained by the multiplication of generating sets, for by so doing it is possible to carry out complete maintenance work on one engine without appreciably affecting the ship's speed.

The ability to use high-speed non-reversing engines of standard design while retaining a low propeller speed is conducive to high efficiency, and the saving in weight and space in the engine room by the use of high-speed engines is quite considerable. The ability to use pilot-house control is another advantage, particularly in the case of ferries, tugs, &c.

Such plant is adaptable to restricted space, and the possibility of utilising part or the whole of the main machinery for other purposes is useful for special craft, such as coastguard cutters, fire boats, salvage boats, trawlers, dredgers, cargo vessels with large refrigerator spaces, and bulk freight vessels with large unloading equipment, such as tankers.

Ability in the case of tugs to vary the propeller speed to suit the towing conditions while maintaining the maximum engine speed and power is also a valuable asset.

Turbo- and Diesel-Electric Drives

The advantages of turbo-electric over geared turbine drive includes flexibility of control; absence of torsional vibration; high economy at reduced cruising speeds in the case of variable-speed vessels; elimination of reversing turbines and all cross-connections as well as a number of shaft packings; ability to use high pressure and superheat; ability to place the propeller motors in any part of the ship, irrespective of the position of the turbines; and ability to obtain economy by means of continuous performance records.

The Diesel-electric drive has been used with great success on small vessels such as tugs, ferries, cutters, trawlers, tankers, and general cargo vessels, where d.c. with its excellent manœuvring characteristics can be used to advantage.

As the size of the vessel increases, the weight and the cost of Diesel-electric machinery become greater than those of turbo-electric machinery, even if the boilers are taken into account. Furthermore, for the very large powers required in the present-day liners alternating-current machinery is desirable. The maintenance cost of a Diesel-electric installation of large power is also considerably higher than for a turbo-electric equipment of similar power, due, of course, to the large number of wearing surfaces and working parts.

One great advantage of the Diesel-electric drive is the elimination in the case of tugs, ferries, &c., of all stand-by boiler losses, as on such vessels the actual time under way is often quite a small fraction of the total time, and the boiler losses are therefore considerable.

Comparison of Propeller Motors

For speeds below 200 r.p.m. a synchronous motor weighs from 10 to 20 per cent. less than an induction motor of similar output, and therefore costs less.

The efficiency of a large synchronous motor is from 3 to 5 per cent. higher than that of an induction motor; it can operate at unity power factor and thus requires a generator of only 80 per cent. of the capacity of that required by an induction motor, and it therefore follows that the generator cost is less (about 15 per cent.).

The larger air-gap permissible with a synchronous machine allows cheaper construction and its poles can be removed without taking the rotor out of the stator; thus both armature and field coils can be replaced without dismantling. For these reasons the synchronous motor is the more satisfactory.

Boiler Water Troubles

The conditioning of boiler feed water is the subject of the paper which Mr. V. B. Harley-Mason, chief engineer of the Manchester Steam Users' Association, read at the East Midlands section of the Institute of Fuel on April 8th at Nottingham.

Suspended matter must first be got rid of by filtration, or in settling tanks. Softening comes next, usually by a continuous process, since intermittent plant demands a good deal of attention. Chemical processes take about two hours to complete, so that a tank to contain sufficient water for two hours' maximum demand is essential.

The "Zeolite" process needs no measuring or proportioning gear; calcium and magnesium salts are converted to sodium salt, which remains in the water. The process possesses far greater efficiency than the lime-soda process and will produce "zero hardness," but for boiler work it is not an unmixed blessing, as it tends to cause caustic embrittlement.

Ill-effects of Oil

The large amount of mischief which a small quantity of oil will do is amazing. A large proportion is removable by mechanical separators. If the oil is finely divided it cannot be separated by levigation (even if left standing for twelve months) or caught by the finest filter.

The best way is coagulation by the addition of sulphate of alumina and sufficient caustic soda to effect precipitation of a flocculent character to entangle the oil globules. The action of the de-oiler is similar to that of a water softener, but greater care is necessary.

An electrical method is the use of a tank containing closely spaced grids or plates of iron. The oily water to be treated is made to flow between the grids and an electric current is passed through it from grid to grid. The effect is similar to the chemical method; the oil globules are entangled in a flocculent precipitate, which in this case takes the form of iron hydroxide.

When the amount of dissolved gas is not large, feed-water heaters of the cascade type, if suitably vented, are quite effective. They will remove the bulk of the trouble and any residue can be dealt with by chemical absorbers, such as tannin, or by passing the water through a filter bed of finely divided iron.

All air leakage into the feed system or any other means of aeration must, of course, be prevented as far as possible.

Welding Aluminium Electrically. By A. J. T. Eyles

Methods and procedure

THE electric welding of iron and steel has made immense progress, but comparatively little has been published of the application of electricity to the welding of aluminium and its alloys, although these have become very important materials to the automobile, aircraft, electrical and general engineering industries.

Manufacturers of aluminium and aluminium alloys have devoted considerable attention to the welding question, particularly as many aluminium soldered joints fail because the metals in the soldering alloys are electro-negative to aluminium. Consequently upon contact with moisture galvanic action is set up so that the joint disintegrates by auto-corrosion, unless the soldered joints have been protected against atmospheric conditions and damp situations by suitable paints or enamels.

During the last two years extensive investigations have been conducted in this country and the United States. As a result, arc welding of aluminium, heretofore regarded as impracticable, has been developed to a point of commercial utility, and within certain limits it may be considered practical as a production method.

The electrodes used should have the same composition as the material welded and a heavy coating of flux to envelop the arc, which should be as short as possible. Reversed polarity and comparatively low currents are used (85 to 100 A for a ⅛-in. rod). Experience shows that a good welding flux is as important in arc welding as it is in the oxy-acetylene or oxy-hydrogen welding of aluminium and the various alloys of the metal.

The actual welding operation by the arc process presents little or no difficulty when the proper electrodes are used. The welding should be carried out as quickly as possible, due regard being paid to soundness of deposit and adequacy of penetration.

Where applicable, the arc welding process will be found to be more economical than either the oxy-acetylene or oxy-hydrogen processes. The initial cost of arc welding plant and the price of electrodes are both high, but this extra initial cost is more than balanced and an all-round saving obtained from the reduction in operating costs and the relatively low cost of electricity as compared with oxygen, hydrogen and acetylene.

Atomic-hydrogen Arc Welding

The question of welding in a hydrogen atmosphere is one that is receiving considerable attention at the moment, particularly in connection with the fabrication of aluminium containers or vessels. As a result of experiment, it has been found that more homogeneous and ductile welds are obtained.

The atomic hydrogen welding process utilises the passage of a stream of hydrogen through the arc between two electrodes. The heat of the arc breaks up the hydrogen molecules into atoms, and these combine again a short distance beyond the arc into molecules of gas. In so doing, they liberate an enormous amount of heat and thus an effective welding temperature is obtained.

Although atomic hydrogen is undoubtedly a very active reducing agent, the temperature at which this reducing action takes place is too high to rely upon it entirely when welding aluminium or aluminium alloys; therefore it is advisable to use a good aluminium welding flux as in gas welding. There is no particular disadvantage in using a flux when welding aluminium with the atomic hydrogen process, but there is a distinct advantage in using hydrogen in keeping the atmosphere away from the weld and making sure of a deposit of pure metal.

An aluminium weld made by this process is extremely ductile and can be bent and hammered without risk of fracture. Another advantage of welding aluminium with the arc and atomic hydrogen processes is that difficulties due to distortion are invariably less pronounced than when the oxy-acetylene system is used, as the heating effect with the electrical methods is localised. This also results in less residual internal stress in the welded structure.

After welding with the arc or atomic hydrogen the completed weld joint and the surrounding metal must be thoroughly cleaned by washing and brushing with hot water to remove all traces of the flux, thereby preventing subsequent corrosion of the metal.

Resistance Welding

Electric resistance butt welding of aluminium differs little from the ordinary practice. In works where much butt welding of aluminium wires is done automatic welding machines are generally used, there being a definite current, pressure and time for the complete operation.

Electric spot welding of aluminium has been developed during the past few years to a stage where it is used in regular production in the fabrication of sheet aluminium products. Spot welding is a branch of resistance welding and is extensively used in place of riveting, as it affords a very economical means of joining together two or more pieces of sheet or strip material.

Special Contacts Necessary

The chief difficulty encountered in the spot welding of aluminium and its alloys is due to the readiness with which aluminium alloys with copper. The ordinary copper electrodes become coated with a layer of aluminium-copper alloy, and if this coating is not constantly removed poor welds and burned material almost invariably result.

In spot welding aluminum the best results are obtained by using special electrodes tipped with an alloy, such as the copper-tungsten alloy. This, owing to its increased resistance, enables a higher surface resistance to be obtained between the welding points and the metal to be welded, which assists in obtaining the necessary welding temperature. Also, owing to the fact that the alloy is a poorer conductor of heat than copper, it helps in preventing the heat generated at the point of the weld from being dissipated so rapidly, the process being thus facilitated.

Another practical method of preventing the alloying of aluminium with copper electrodes consists in chromium plating the electrode tips, or a piece of chromium may be inserted in the copper tips. When spot welding aluminium it is very important that the electrodes and the electrode holders shall be water cooled. Owing to the high current density required with aluminium, the electrodes become heated in a short time unless the cooling system is adequate.

Electrode Requirements

The size and shape of the electrode tip are important. The diameter of the contact surface should be between ⅛ in. and ¼ in., the larger dimension being for thick sheets and plates. The contact surface of the electrodes should be slightly rounded (convex). This requirement is essential when spot welding thin sheet material to produce a spot weld uniform in shape and quality.

In practice, it is found that it is necessary to use only about one-third to one-half of the pressure on the electrodes as compared with spot welding iron or steel. Experience in welding metals teaches that aluminium is one of the few metals that does not become plastic until melting temperature is closely approached, and it must be welded almost instantaneously in order to ensure that a good and reliable joint is obtained.

Aluminium requires no special preparation for spot welding. The chief requirement for a satisfactory spot weld is that the metal must be clean and free from dirt or heavy oxide coating which would prevent metal-to-metal contact. Dirty aluminium can be cleaned by abrasion or dipping in a 20 per cent. (by weight) caustic soda solution, neutralising in a 15 per cent. (by volume) nitric acid solution, and then thoroughly washing in hot water.

Automatic spot welding machines are recommended for welding aluminium sheet. Aluminium has a rather narrow welding range, and for this reason time, current and pressure should be accurately controlled. Regarding the pitch of the spot welds when welding aluminium sheet or plate material the character of the work must be the determining factor. However, four distinct spots to the inch can be made where necessary.

A Large Marine Crane

What is claimed to be the largest Diesel-electric self-propelling floating crane so far constructed has been built in Italy by the Cantieri Riuniti dell'Adriatico for use at the Port of Trieste. It has nine d.c. 220-V motors, driving through gearing, and controlled on the Ward-Leonard system. The 150-ton and first auxiliary 50-ton hoisting motors are 110-h.p. 400 to 800-r.p.m. machines, as is also the luffing motor. The second auxiliary 10-ton lifting motor is of 50 h.p. at 500 to 1,000 r.p.m. For slewing there is an 80-b.h.p. 500 to 1,000-r.p.m. motor; for moving the driver's cab a 30-h.p. 750-r.p.m. motor is used, and a 50-h.p. 500-r.p.m. motor moves the crane athwartship on the pontoon. The two propelling motors are of 150 b.h.p. each at 1,000 r.p.m. The two Diesel-driven generators have a total output of 440 b.h.p. Auxiliary plant includes an air compressor, 20- and 4-h.p. motor-driven pumps, and an oil-electric lighting set of 5-kW for use when the main plant is not in service.—*Motor Ship.*

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

High-voltage Sub-station Insulators

The correspondence which has taken place in the Electrical Review between Mr. G. H. Hatton and Mr. R. C. Andersen is very interesting. We are, however, obliged to say that the first statement made by Mr. G. H. Hatton and his reply to Mr. Andersen are far from being technically correct.

It is really asking too much of anybody to believe all that has been said. Regarding the stresses, which, according to Mr. Hatton, may cause fracture of porcelain insulators, we should think that the first one (inherent thermal stresses) applies to the new designs proposed as well as to any other design, the more so as we are made to believe that the mechanical strength of this new type of insulator can be graded according to the thickness of the porcelain wall.

We would also say, and experience has confirmed this, that inherent thermal stresses and firing difficulties are greater with thick porcelain. At the same time, on going back to the first paper, we would say that it is quite true that cylindrical types of insulators are an improvement as compared with the multi-part construction manufactured by the firm mentioned, *i.e.*, Steatite & Porcelain Products, Ltd. This is an entirely internal affair, but it should be pointed out quite clearly that the multi-part insulator shown does not bear any resemblance to a modern multi-part insulator made by firms which have years of experience behind them in the manufacture of high-voltage insulators.

The Lyceum stage; a picture taken during the first scene of *The Miracle*
(*See* "*Modern Theatre Lighting*," *p.* 557)

Therefore the sweeping statements made as to the great advantage of cylindrical type insulators may be correct if applied to the multi-part insulator of antique design shown in the first paper.

Cylindrical insulators are not new, but their disadvantages regarding electrical characteristics and mechanical strength are so great that in the course of time they were replaced by the multi-part construction of insulators of modern design, and such insulators have given users every satisfaction.

British Porcelain Co., Ltd.

London, S.W.1, *April* 11*th*, 1932.

In his critical analysis of my letter in your issue of April 8th, Mr. Hatton subdivides destructive insulator stresses into four categories, two of which he associates directly with porcelain *per se* and two with outside agencies, thus:—

Group I. Relating to porcelain.	Group II. Relating to outside agencies.
1. Inherent manufacturing thermal stresses.	3. Cement stresses due to "ageing."
2. Expansion and contraction of the porcelain body in service.	4. Stresses due to the difference in expansion coefficient of porcelain, cement and metal.

Group I, which he designates as "thermal," is dismissed by Mr. Hatton because in modern porcelain these stresses no longer play a destructive rôle. With this contention I am in complete agreement.

Group II he designates as non-thermal, and this explains his statement . . . "porcelain breakdowns due *not* to thermal stressing but to bad designs which disregard the properties of cement, &c. . ." I, on the other hand, designate stress 4 as "thermal," for it derives directly from temperature change. I believe my choice of terms is rational, but for the purpose of this letter I will use Mr. Hatton's vocabulary.

Having eliminated Group II stresses (which, incidentally, I do not agree have been responsible for past insulator failures on a scale as large as Mr. Hatton would have us believe), your correspondent curiously deplores the fact that "progress in design, in this country at any rate, has not kept pace with progress in the ceramic art." This is a sweeping indictment and I have therefore been at great pains to discover from Mr. Hatton's letter what he deems to be progressive design. I can reach no conclusion other than that according to him a good design is as nearly cementless as possible, while a bad design is one that uses cement. Surely this is a strange basis on which to compare insulators.

The multi-part pedestal insulator is damned because it has "layer upon layer of cement." But how about electrostatic balance, dielectric strength of porcelain made in sheds of rational section, puncture strength, rapid heat transmission through the insulator body, the theory of probabilities applied to insulator depreciation? These are critical factors in design. Must the advantages implicit in these factors—associated as they are with multiple sheds—be thrown into the limbo of forgotten things merely because Mr. Hatton objects to the use of what he calls "layer upon layer of cement"?

I am really sorry to learn that Mr. Hatton finds "ageing" of cement such a live bogy. This immediately explains why to him cement is anathema. Nevertheless I can assure him it has long ceased to worry reputable insulator manufacturers who use cement deliberately as the best vibration- and heat-resisting material extant for insulator assemblies.

It is the mishandling of cement that has given rise, practically wholly, to the sub-station porcelain breakdowns alluded to. Against these breakdowns stressed by your correspondent stand the impeccable service records of soundly designed and assembled multi-part insulators extending over many years. What service records for the cylindrical insulators has Mr. Hatton to offer by way of contrast?

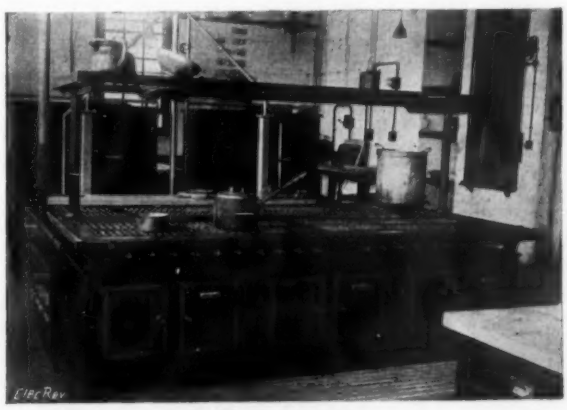
I would suggest that Mr. Hatton should carefully study the fundamentals of the design of multi-part insulators and check up the claims made for these by leading insulator manufacturers against actual records in service which are really not so woefully scant as he states.

In the ultimate analysis it is service that counts, and on this basis the multi-part insulator has quite definitely established itself. On the other hand, as indicated in my last letter, it will be most interesting to observe the service record set up in due course by the cylindrical insulator.

London, S.W.1, *April* 9*th*, 1932. R. C. Andersen.

Hybrid Cookers

The idea of combining electric ovens with a gas boiling and grilling plate is not new, as I was responsible for the installation of a six-oven range of this type in 1918, for canteen service. The range in question has ovens measuring 22 in. by 22 in. by 20 in. loaded to 6 kW per oven supplied by two three-phase sub-circuits from a three-phase 115/200-V supply, the ovens being connected to the phases and balanced.



A gas-electric cooker

The use of gas was decided upon for the top cooker because of the known drawbacks of the boiling plates of the day, and also because of the relatively high cost of operation of the 6-kW boiling plates that would have been fitted to a cooker of this type. The cooks were quite satisfied with the arrange-

ment, and there seemed to be no trouble with it so far as the combination of the two sources of heat were concerned.

The makers were Carron Company, and I believe it was not the first time the hybrid type of range had been constructed. H. B. Leighton.

Sheffield, *April 8th*, 1932.

In your April 8th issue Mr. F. Risch characterises the merits of our electric boiling ring as being founded on a bold assertion, and bases his opinion on his presumption that the apparatus is quite *new*.

For his information we may record that it was introduced, patented and placed on the market some six years ago, since when it has been regularly included in our advertisement propaganda. It has also formed the subject of articles in the Electrical Review and other publications which have apparently escaped the notice of your correspondent.

As to gas rings, we are at variance with the view he takes. There is a limit to the degree by which the gas can be lowered with safety without being blown out by draught or movement. Moreover, in using the tap it is necessary to take special care, whereas for simmering with the electric hot plate it is merely necessary to turn the switch, no care being required, while the element is not affected by draught, &c.

We should be happy to demonstrate the apparatus under working conditions, either to your correspondent or to any other of your readers who may be interested.

London, S.E.1, *April 12th*, 1932. William Geipel, Ltd.

Neutral Fusing

Since with very few exceptions modern supplies are given by four-wire a.c. or three-wire a.c., having one conductor earthed, why should one fit fuses in the earthed conductor as is customary?

The Memorandum by the Chief Electricity Inspector on the Factory Regulations states (Regulation 9): "Where one of the conductors of a system is connected to earth, no single-pole switch . . . may be placed in such conductor or any branch thereof." No mention is made of fuses.

Now surely such fitting of a single-pole switch is forbidden to prevent the possibility of the circuit being opened on the "dead" side, and remaining alive, but if a "dead" side fuse were drawn from a two-pole fuse board the same conditions would exist.

Regulation 7 provides for means to be available for cutting off all pressure from a system. The Memorandum states quite definitely here that the "means" may be an isolating link. Now a fuse is used as an isolating link, but the memorandum also states that where a conductor is permanently earthed no "means" need be provided for that conductor.

From this, therefore, it may reasonably be supposed that where one conductor of a system is permanently earthed, it would be quite in order to wire the system with single-pole switches throughout, on the live side, with single-pole fuseboards, using a common bar for the returns on the "dead" side. It could, in fact, be agreed that such fitting of fuses on the "dead" side was dangerous.

The further the matter is considered the more it appears that we are fitting two-pole protection because our fathers did the same thirty years ago. Delta.

April 10th, 1932.

An Unreliable Profession

I have read with interest the letters on this subject appearing in your issue of April 1st.

As one of the unfortunates, out of a berth, and with a similar experience of negative acknowledgments to that of Mr. A. H. Palmer, together with the experience of previous years, I have concluded that the "profession" is unreliable and disappointing, much as I would like to believe otherwise.

I have heard many others express themselves in the same way with varying degrees of feeling on the matter, so that it is not surprising this subject should appear in your correspondence columns. There may be those out of a berth who are somewhat at fault themselves, but there are certainly many who are "out" through no fault of their own.

Moreover, it cannot be disputed that as a "profession" electrical engineering is well beneath the other professions, it has not the same status, nor can it command the respect of the others. Any person with the remotest connection may be classified as an "electrical engineer." It is regrettable that there are those who have found and think of the "profession" in this way, but the facts remain. Would that it were so much otherwise.

If, as "Engineer" states, "there is still room for good engineers," in reliable positions, then there are those who would only be too delighted to hear of such opportunities.

April 7th, 1932. Engineer II.

Electric Clock Wiring

May I be allowed to comment on the very useful article on this subject in your issue of March 25th? At the present time many people no doubt are meeting the problem of wiring up electric mains clocks, and Mr. Holmes in the above contribution has provided them with much useful information and many "tips."

I think there can be no doubt that the condenser plug method is the ideal arrangement—the socket of the plug being wired *direct* to the consumer's side of the meter if possible, in order to avoid interruption in the functioning of the clock which intermediate fuses and switches may introduce. One point, however, I think needs more emphasis than Mr. Holmes has given to it. The value of the series condenser *should be as near the optimum value*—derived from $\frac{1}{\omega C} = 2\omega L$—as possible.

One standard plug with a fixed value will not be satisfactory for various makes of clock. In the case of the clock tested by Mr. Holmes, his figures give 0.051μF for the optimum value and twice this, of course, for resonance. Now the condenser plug he mentions has series capacity of .075μF, and, as his curves show, if this plug were used with his clock the current and voltage on the clock would be appreciably larger than without the condenser, and the latter would have on it nearly *twice* the mains voltage.

A condenser plug with series capacity 0.1μF, which might be suitable for some other clock, would give resonance on his clock producing undesirably high voltages and currents. I have recently tested a clock made by a well-known firm, and on 220 V found the following approx. figures:—

I=8.4 mA, impedance 26,000w, effective resistance 13,000w, inductance 70 H.

The optimum value of series capacity for my clock therefore would be 0.071μF. This was checked by a further test in which a variable capacity was put in series with the following results:—C=.05, .069, .075μF.

I=5.2, 8.3, 9.45 mA.

I think it is clearly desirable that manufacturers should include particulars of the condenser method and the correct value to use in the instructions which they usually issue with their clocks.

There is one small misprint in Mr. Holmes's figures. I, .065 A should obviously be I, .0065 A. R. A. West.

Military College of Science, Woolwich.

April 7th, 1932.

Progress

It may interest you to know that during the year ended March 31st, 1932, the increased rate of connections has been over 100 per cent., *i.e.*, 2,068 compared with 1,017 in the previous year. F. V. L. Mathias,

Borough Electrical and Tramways Engineer.

Warrington, *April 12th*, 1932.

New Books

Production Planning. By Clifton Reynolds. Pp. 229; figs. 28. London: Sir Isaac Pitman & Sons. Price 10s. 6d.

The subject is treated on very broad lines, much of the matter discussed not being connected to any great extent with productive activity. The book is intended for people who have difficulty in finding their requirements in books dealing only with large factories: it should also prove useful to students of the subject of management. The work also points out that "Taylorisation"—that is the scientific principles of Dr. F. W. Taylor—may be extended to the scientific control of overhead charges. The book is divided into three parts dealing with planning for sale, planning for economy, and planning for co-ordination.

Steel-Cored Aluminium Transmission Lines. Pp. 143. Illus. London: The British Aluminium Co., Ltd.

This book describes electricity transmission schemes in several countries.

Maps are included showing the primary lines, and very many photogravure illustrations of the transmission towers and lines appear. Full line details are given throughout, and in the case of the Central Electricity Board's schemes the main contractors' names are given.

* * *

Shorter Notices

"High Speed Oil Engine Design," by B. Reed and H. Tanaka. Pp. 70; figs. 43. London: Draughtsman Publishing Co., Ltd. Price 2s.—The book is divided into six sections, dealing with thermo-dynamics, general construction, injection systems, engine detail design, and crankshaft design and connecting-rod design. In addition to illustrations and drawings, eleven tables are included.

"The Mathematics of Wireless," by R. Stranger. Pp. 196; figs. 113. London: George Newnes, Ltd. Price 5s.

"1932 Supplement to the Principles and Practice of the Assessment of Gas Undertakings," by H. T. Seymour. Introduction by H. E. Ibbs. Pp. 308. London: Walter King, Ltd. Price 5s.

"Thomas A. Edison," by F. Trevelyan Miller. Pp. 287; 21 plates. London: Stanley Paul & Co., Ltd. Price 18s.

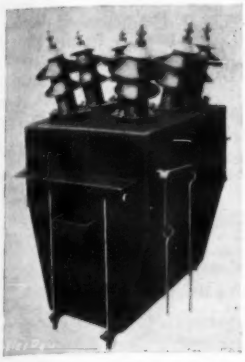
"Practical Physics," by W. R. Bower and J. Satterly. Pp. viii+492; figs. 275. London: University Tutorial Press. Price 7s. 6d.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Pole-mounting Circuit Breaker

An outdoor automatic circuit-breaker of a new design for overhead lines has recently been put on the market by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester. It is an inexpensive hand-operated oil breaker suitable for pole mounting, on the side of a power transformer, or on a floor-mounting stand. An unusual feature of the apparatus is its two-part construction. The upper part, which is designed for bolting permanently to a pole structure or other support, consists of a weather-proof welded-steel hood or terminal housing. In this are mounted the leading-in insulators and a set of six terminal contacts of the butt pattern, each suitably insulated. The lower part is a detachable tank in which a three-pole circuit-breaker is mounted and completely immersed in oil. A second set of six butt contacts on the circuit-breaker unit engages with those in the terminal housing; thus the complete breaker can be withdrawn from the hood and taken away without disturbing the connections to the line or the load.



An M.-V. pole-type breaker

Special attention has been paid to simplicity of design and construction, with a view to reducing to the minimum the cost of maintenance, which can be carried out easily and quickly on site. The type "G.P." breaker is supplied for ratings up to 100 A, for use on three-phase circuits up to 11,000 V; it is specially suitable for connection to secondary overhead lines, where it can be used for line sectionalising or for controlling a transformer circuit tapped off a high-voltage supply. Short-circuit tests have shown that a three-pole equipment fitted with 20-A (or larger) trip coils has a rupturing capacity of not less than 50,000 kVA at 11,000 V.

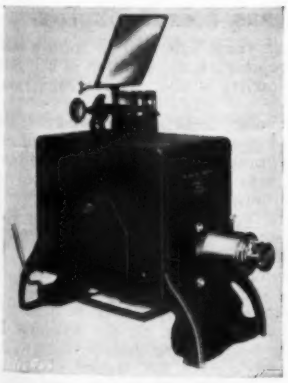
Various standard arrangements are available for admitting the cables; they include through insulators on top (as illustrated); through insulators on one side, suitable for transformer mounting, cable tails, cable boxes for compound filling, and combinations of any two of these. The approximate overall dimensions of the circuit-breaker illustrated are height 29 in., width 25 in., depth 16¼ in.

A Single-lamp Epidiascope

MESSRS. NEWTON & CO., 72, Wigmore Street, W.1, have recently produced a new high-intensity epidiascope fitted with special diffusion reflectors.

The greater part of the instrument is made of cast aluminium.

This apparatus enables lecturers to illustrate their remarks not only with lantern slides, but also with maps, printed matter, illustrations, books, fabrics, botanical specimens, and small natural objects—in fact almost any article that is reasonably flat—and these are projected very considerably enlarged and in natural colours.



A new high intensity epidiascope

Sheets up to 20 in. wide by an indefinite length may be used, a portion 6 in. square being projected at one time. The lifting table on which the object to be projected is laid is underneath the body of the instrument, and on turning a lever the object is moved up parallel to the opening at the base of the body, and is there held flat ready for projection. Focusing is achieved by turning a milled head at the side of the objective.

A special attachment is provided for the use of lantern slides, and a small projection microscope may be used by means of a slight adjustment.

Only one 500-W lamp is used, as this is sufficient with diffusion reflectors. Four models are available with 3, 16, 20, and 24-in. lenses.

A Smoke Indicator Unit

By means of an automatic smoke indicator, made by RADIOVISOR PARENT, LTD., 28, Little Russell Street, W.C.1, the density of smoke can be ascertained before it reaches the top of the stack; operation of the controls is therefore greatly facilitated. The apparatus consists of a light projector, a receiver containing a light-sensitive cell, and a control box.

A beam of light is projected across the base of the stack (or the boiler up-take) and directed upon the receiver. Electrically connected to this receiver is the control box, which may be in any convenient place, but preferably near the receiver. The projector lamp has a short, thick filament in order to obtain a concentrated beam of light, and takes 2 A at 11/12 V. When a number of units are reasonably close together the projector lamps can be wired in series, and, with a suitable resistance element, run direct from the mains. Where a.c. is available a small transformer is supplied for each lamp.

The control box contains an instrument showing the variation in density of the smoke passing through the beam of light. A knob below the indicator serves as an electrical "zero adjustment" to set the instrument as desired. Once set it requires no further attention.

An additional and larger indicator with an 8-in. dial can be supplied, provided with a scale shaded from white to black. A recording instrument can be used for permanently recording the variations of smoke density.

A Handy Radiator Heater

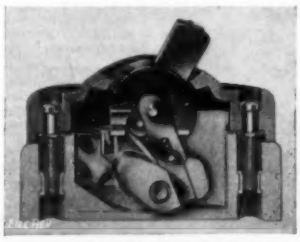
A portable electric radiator heater for automobile engines has recently been marketed by GEORGE BRAY & CO., LTD., Leeds.

A radiator heater

It has a totally enclosed "Chromalox" element embedded in a refractory material, which is enclosed in a chromium steel sheath. An outstanding feature of the heater is that petrol is not ignited if it is spilt on the heater. The loading is 100 watts. Three yards of flexible cable and a lamp holder adapter are provided, and the heater is finished in black enamel.

A New Flat Switch

A small 15-A flat switch on a base only 2¼ in. in diameter has recently been marketed by J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall. This "Lincoln" switch has an all-steel mechanism and a substantial china block for carrying the floating contact rod. The auxiliary arcing-tips and the method of suppressing the arc are also worthy of notice in view of the use of the switch in heating circuits.



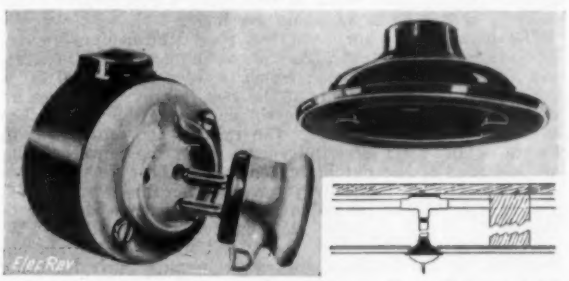
The "Lincoln" 15-A switch

The switch is made with a brown "Bakelite" cover and a white base; it may be obtained all brown or all white at a slight extra cost. Suitable blocks are available for the switches. Five- and 15-A "Lincoln" switch-sockets are also procurable.

New "Simplex" Fittings

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham, have produced a new 5-A plug and socket conduit fitting. This has a stone-hard white china plug and sprung sockets (2-pin with B.S.S. centres). It is also supplied in brown china at a slight extra cost, and in three sizes, ⅜ in., ½ in., and 1 in. The socket entries are surrounded by a circular ridge into which the plug fits, providing a shield, and, as will be seen from the illustration, special provision is made for the connecting flex.

A range of new flanged ceiling fittings, made of malleable iron, has also been put on the market by this company. These are tapped for ⅜ in. or ½ in. conduit, and the two internal lugs have tapped fixing holes set at 2-in. centres. Standard conduit



New "Simplex" fittings: (Left) Plug and socket. (Right) Ceiling attachment

roses, ceiling roses, and ceiling plates may be attached directly, as the flange covers the edges of the hole in the ceiling. The method of employing this fitting is illustrated.

United States Electrical Exports

Figures for 1930 and 1931 compared

OFFICIAL statistics relating to electrical exports from the United States during 1931 disclose a decrease of over 29 per cent. as compared with 1930, the total amounting to only $92,695,345 (against $131,214,930). Below appears an analysis of the year's figures, with notes of increases or decreases; the values are given in thousands of dollars on account of the variation in the exchange caused by our abandonment of the gold standard towards the end of last year.

Large shipments to Soviet Russia were responsible for the substantial increase in exports of a.c. generators of 2,000 kVA and over, while the advance in exports of complete radio receiving sets—one of the few other classes of goods to show an improvement over the previous year—was due to a large extent to the fact that Great Britain's purchases rose from $405,000 to $1,918,000. Argentina also increased its imports of radio receivers, taking $1,711,000 instead of $1,226,000, and shipments to Sweden rose from $134,000 to $999,000. With regard to the refrigerator market Canada, purchasing goods to the value of approximately $1,500,000, heads the list of customers, while of the European countries the United Kingdom, Belgium and France were the largest importers, having imported $706,000, $565,000, and $258,000 worth respectively.

Of the total exports of $92,695,345 Canada was responsible for $10,653,003, and although the figure is $13,410,237 lower than in 1930, this market continues to be the principal destination of American electrical goods. Shipments to the United Kingdom increased by $43,662 to $9,619,931, and Soviet Russia with goods valued at $6,470,087 purchased $1,195,297 more. There were decreases of $485,399, $1,011,415, and $2,977,984 respectively in the exports to France ($3,112,501), Italy ($2,278,478), and Argentina ($6,170,594).

	1931 Thous. $.		Inc. or Dec. Thous. $.
Electrical machinery and apparatus (total)	85,080	–	33,176
Generators—			
Direct current—			
Under 500 kW.	288	–	456
500 kW. and over	187	–	273
Alternating current,			
Under 2,000 kVA.	137	–	173
2,000 kVA. and over	1,030	+	370
Steam turbine generator sets	1,020	–	580
Accessories and parts for generators	1,050	+	342
Arc welding sets	540	+	100
Self-contained lighting outfits	340	–	506
Batteries—			
Flashlight batteries	2,000	–	1,020
Radio B. and C. batteries (dry)	325	–	255
No. 6 dry cell batteries	450	–	130
Six-volt storage batteries	1,470	–	340
Other primary batteries	110	–	160
Other storage batteries	700	–	590
Transforming or converting apparatus—			
Power transformers, 500 kVA. and over	1,010	–	1,000
Distribution transformers, less than 500 kVA.	570	–	1,290
Instrument transformers	150	–	90
Battery chargers, under 15 amps.	55	–	95
Other transformers	490	–	690
Double-current, and motor generators, dynamotors, synchronous, and other converters	1,150		—
Transmission and distribution apparatus—			
Switchboard panels, except telephone	1,530	–	630
Switches and circuit breakers over 10 A.	1,220	–	1,170
Fuses	180	–	203
Watt-hour and other measuring meters	570	–	160
Indicating instruments	530	–	300
Recording instruments	310	–	140
Other testing apparatus	630	–	290
Lightning arrestors, choke coils, reactors and other protective devices	560	–	290
Motor starters and controllers—			
Motors, ¼ h.p. and under	1,490	–	920
Motors over ¼ and under 1 h.p.	335	–	325
Stationary motors—			
1 to 200 h.p.	1,490	–	,900
Over 200 h.p.	630	–	60
Railway motors	180	–	20
Electric locomotives—			
Railway	170	–	700
Mining and industrial	440	–	300
Station and warehouse electric motor trucks	220	–	60
Starting and controlling equipment—			
For industrial motors	1,270	–	380
For electric railway and vehicle motors	240	+	80
Portable electric tools	790	–	420
Accessories and parts for motors	1,760	–	650
Radio apparatus—			
Transmitting tubes, sets and parts	805	–	335
Receiving sets	14,360	+	2,810
Radio receiving tubes	1,950	–	410
Receiving set components	3,890	–	485
Other receiving set accessories	570	–	2,260
Loud-speakers	1,060	–	630
Telephone apparatus—			
Telephone instruments	320	–	210
Telephone switchboards	100	–	850
Other telephone equipment	1,640	–	2,250
Bells, buzzers, annunciators and alarms	490	+	140
Telegraph apparatus	310	–	450
Electrical appliances—			
Electric fans	430	–	620
Health exercisers	30	–	94
Electric lamps—			
For motor cars, flashlights and Christmas trees	215	+	21
Other	600	–	417
Other electric lamp bulbs	90	–	180
Flashlight cases	530	–	850
Searchlights and projectors	290	–	230
Household washing machines	870	–	840
Vacuum cleaners	1,180	–	540
Flat irons	200	–	70
Cooking ranges	410	–	30
Other motor-driven devices, except tools	450	–	370
Industrial electric furnaces and ovens	900	–	110
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	1,120	–	480
Other electrical apparatus—			
Spark plugs	1,430	–	270
Other starting, lighting, and ignition apparatus	670	–	690
Insulating material	560	–	560
Metal conduit, outlet, and switch boxes	580	–	630
Sockets, receptacles and lighting switches	1,370	–	430
Electric interior lighting fixtures	1,200	–	900
Electric street lighting fixtures	290	–	210
Other wiring supplies and line material	90	–	1,400
Other electrical apparatus	4,660	–	5,380
The following, not included in the total of electrical apparatus, were also exported :—			
Insulated copper wire and cable—			
Rubber covered	450	–	470
Weatherproof	280	–	40
Telephone cable	140	–	140
Other insulated copper wire	1,710	–	1,410
To United Kingdom	300	–	70
Canada	170	–	400
Chile	340	+	190

The Dock Sud Power Station

(FROM OUR BUENOS AIRES CORRESPONDENT)

THE Dock Sud power station, situated on the banks of the Riachuelo, in the port of Buenos Aires, and jointly owned by the Buenos Aires Western and Great Southern Railway Companies, was recently purchased by the supply company, the Cia. Hispano-Argentino de Electricidad, and was transferred to the latter on March 12th.

Built to the designs of Messrs. Merz and McLellan and costing over £500,000, the power station went into regular service in 1923, feeding the Western Railway suburban electrification scheme and providing electric power to the two railway companies for their locomotive and carriage workshops, terminal stations and suburban station power and lighting services, &c. The station contains fourteen Babcock and Wilcox marine type water-tube boilers fired by either coal or petroleum fuel, and designed for a working pressure of 210 lb. per sq. in. These boilers have a combined normal capacity of 300,000 lb. of steam per hour.

The generating plant comprises four Metropolitan-Vickers turbo-alternators each of 7,500 kW continuous output, generating 25-cycle a.c. at 2,500 V, which is stepped up to 20,000 V for feeding the sub-stations of the two railway companies by underground cables. The yearly output of the station has averaged 50 million kWh. The railway companies will in future obtain their electrical energy from the power station at Dock Sud of the purchasing company, the C.H.A.D.E., or alternatively from the railway power station recently acquired. The C.H.A.D.E. at present owns two stations in the city of Buenos Aires with an aggregate capacity exceeding 600,000 kW.

The sale of Dock Sud power station is not entirely unexpected, as the Argentine railway companies have for some time considered it preferable to purchase electrical energy from those whose business it is to deal in its supply, and to employ their available capital on works directly concerned with transport. Thus the Buenos Aires and Pacific Railway Company, in conjunction with a development scheme for the city of Bahia Blanca some twenty years ago, had to form a subsidiary company to provide capital for the erection of a 10,000-kW power station on the outskirts of the city at Loma Paraguaya.

The subsidiary company also held the concession for the town lighting supply and the tramways, and in addition supplied energy for the port grain elevators at Puerto Galvan. The subsidiary undertaking was subsequently transferred to the Buenos Aires Great Southern Railway which also owned its own power station at the port of Ingeniero White; the whole of the supply arrangements have recently been transferred to the Italian Electricity Supply Company, and it is understood that the new owners are considering the erection of a modern power station at the port of Ingeniero White.

Other stations which have been shut down include the Pacific Railway's 1,000-kW works station on the outskirts of Buenos Aires, power now being purchased from the C.H.A.D.E.; the same company's 3,000-kW station at Junin, five hours' journey from Buenos Aires, which has been transferred to the Anglo-Argentine Electricity Company; the Midland Railway Company's works station of 500-kW at Libertad; and the Western Railway's works station at Bragado.

The decision of the British owned railways in the Argentine will result in diminished orders for British manufacturers of power-station equipment, but it must be realised that no railway company ever wished to invest capital in generating plant, but in the past has been obliged to do so owing to lack of adequate supply facilities. Now that reliable supplies of electrical energy can be obtained at reasonable tariffs, the railways will naturally purchase their requirements.

Apart from the C.H.A.D.E. and the Italian Supply Co., which operate in the city and suburbs of Buenos Aires, the outside zones of the Republic are mainly supplied from power stations owned by North American undertakings which have invested heavily in the business during recent years.

Contractors' Supplies in Australia

A D.O.T. review of market conditions

ALTHOUGH no actual production figures are available, it is estimated that between 80 and 90 per cent. of the total business in Australia for electrical contractors' supplies (which covers such items as conduits and conduit fittings, fuse boxes, distribution boards and electrical accessories, but not cables and wires) is held by Australian manufacturers, according to a recent Department of Overseas Trade report by H.M. Senior Trade Commissioner in Australia.

The import trade in these supplies is largely in the hands of United Kingdom and United States firms, with comparatively small but relatively increasing quantities from Germany, Switzerland, and Belgium, especially the first named. Recent increases in the trade in wires and cables from Holland and Belgium at lower prices than the British have had their effect also on the trade in accessories.

The trade in cheap Japanese fittings, which was secured when supplies from other sources were unobtainable, has now fallen away mainly owing to the inferior quality of the products. The present position held by American firms is also due to some extent to the footing which they obtained during the War, when British materials could not compete; the adoption of American standards for snap and flush switches has also had a great influence on the import trade.

Imports Decrease

The official trade returns of Australia do not separately distinguish imports of the various classes of electrical fittings. The only relevant items in the returns are the following:—

	Year ended June 30th, 1929. £	1930. £
Electric fittings, partly or wholly of metal, viz., switches and fuses, and lightning arrestors, n.e.s.—		
Total	435,624	360,035
From United Kingdom	329,582	263,851
„ Germany	5,275	6,119
„ Switzerland	2,139	5,789
„ United States	96,134	80,149
„ Belgium	5	440
Ironclad or moulded fuses, switches, airbreak switches and fuses combined—		
Total	—	6,182
From United Kingdom	—	4,683
„ United States	—	1,034

(NOTE.—This item has been separately distinguished only since November 22nd, 1929, and the figures therefore represent imports for the period November 22nd, 1929, to June 30th, 1930.)

Electric measuring and recording instruments—		
Total	154,570	112,976
From United Kingdom	72,598	63,275
„ Germany	4,267	4,065
„ Switzerland	19,748	10,136
„ United States	39,781	29,508
„ Canada	17,553	1,976
Regulating, starting and controlling apparatus for all electrical purposes, including distributing boards and switchboards, n.e.s.—		
Total	296,889	366,215
From United Kingdom	182,451	198,478
„ Germany	2,447	5,284
„ Switzerland	3,710	6,177
„ Sweden	1,375	5,170
„ United States	101,400	147,255

No later details are available, but it should be remembered that the business depression in Australia has been greatly accentuated since June, 1930, and, moreover, the imports in 1929-30 were generally in excess of requirements.

The local manufacture of contractors' materials has been encouraged by recent increases in import duties.

Channels of Distribution

Local manufacturers of contractors' supplies usually sell to wholesale merchants, though in some cases they sell at a lower discount direct to electrical contractors. Imported supplies are, however, mainly handled by the local branches of British and American electrical manufacturing concerns and by wholesale dealers in electrical supplies.

Electrical contractors do not as a rule import their supplies direct, but purchase their requirements from the merchants and branch houses referred to above, the principal reason being that as contractors they do not wish to be concerned with such questions as freights, changes in duty, and exchange rates, but prefer to be given an inclusive quotation upon which they can base their estimates for the work for which they tender. Naturally the wholesale merchants do their best to encourage this attitude. An exception may occur when the agent of the overseas manufacturer offers goods at a "landed into store" price, and some business in German lampholders has recently been done in Melbourne with a firm of contractors on this basis.

The above represents the position in the larger centres, *viz.*, Sydney and Melbourne. In the smaller State capitals where there are fewer wholesalers and a smaller volume of business, electrical contractors do a fair amount of importing. With the opening in these cities of branch houses of Sydney and Melbourne wholesale merchants and of overseas manufacturers, however, the import trade is tending to be confined to the same channels as in the two larger centres.

The retail trade in replacements and in glassware is handled by the ordinary electrical and radio dealers, departmental stores, and also by some of the wholesalers, the tendency being for the wholesaler to get more and more into the retail trade. Occasionally, also, contractors maintain retail stores.

Electricity supply companies are, of course, large buyers of meters, fuse boxes, and distribution panels, but they do not generally undertake contracting work, either with regard to initial installation or subsequent replacement of accessories.

There is, however, an exception in the case of the State Electricity Commission of Victoria, which maintains 40 showrooms in which all kinds of domestic and farm electrical appliances are sold, including lighting glassware. Accessories are not at present handled by the Commission, but it is understood that they shortly will be.

The Sydney Municipal Council in its electrical showrooms also displays samples of manufacturers' goods, and not only sells retail but has canvassers out soliciting orders.

Wiring Regulations

The adoption of a code of uniform safety rules which has recently been published by the Standards Association of Australia should result in greatly improved conditions in the installation and maintenance of electrical wiring systems and apparatus. They have been evolved as a result of an examination of wiring codes in operation in English-speaking countries throughout the world, and the organisations concerned in drawing them up include all the principal public authorities and bodies having any interest in electrical installation work. Arrangements have also been made for interpretations of the rules to be given promptly by the State Sub-Committee of the Wiring Rules Sectional Committee of the Standards Association of Australia.

In New South Wales the rules have been adopted by the Electricity Departments of the Sydney Municipal Council, Manly Council, and Newcastle Council, while in some councils the rules are even more stringent. The Electrical Contractors' and Electricians' Licensing Board of New South Wales uses them in connection with its examinations, and all contractors have now to be licensed by the Board. In Victoria the rules of the State Electricity Commission (which are stated to be the most stringent of those in force in any State) are to be amended and brought into line with them, and in Queensland they have been gazetted as the official regulations under the Electric Light and Power Act.

The Future Outlook

The existing business and financial depression in Australia has resulted in a stagnation in the building trade, and consequently both merchants and contractors have considerable stocks of supplies in hand, which, in some instances, at the present rate of consumption will last for two years or more. There is therefore no likelihood of increased trade consequent on increased demand for some considerable time to come.

With regard to increased British trade at the expense of competitors, it is difficult to foresee any decline in the extent and variety of local manufacture of accessories and fittings. Admittedly importers will not always be hampered by the existing exchange rate, and it is conceivable that rates of duty (and particularly primage duty) may be lowered at some future date, but the present exceptional conditions are providing local manufacturers (including the branch factories of overseas manufacturers) with the opportunity of improving their products and entrenching themselves in the position of principal suppliers.

Locally made products will always receive a preference with public authorities, and provided their quality is maintained and the price kept to a figure reasonably close to that of the imported article, Australian manufacturers should retain the volume of business they have secured.

United Kingdom's Strong Position

With regard to the import trade, the United Kingdom already has a large part of the business. Switches, plugs, and certain other accessories of American and German manufacture are popular on account of the style, fashion, and convenience of installation in the case of American goods, and price in the case of the German articles. There is nothing else in the sales methods of competing manufacturers which secures them the trade as against United Kingdom suppliers, except that some German firms, in attempting to go past the wholesale merchants, are quoting prices direct to the contractor for delivery of the goods into his store.

It will have been gathered from the above that the market is adequately catered for in regard to contractors' supplies, but if any British manufacturer who has not hitherto secured any trade in Australia considers that there is a possibility of business in his lines it will be necessary for him not only to cultivate the London representatives of the principal firms of electrical engineers and dealers, but also to appoint local agents, who will most probably themselves be wholesale indentors and would undertake to push the sale of the products amongst local buyers.

The only State in which regulations governing the registration or licensing of commercial travellers exist is South Australia, where the law requires that a non-resident trader should obtain a licence from the Commissioner of Taxes before he carries on business; a similar obligation is placed on non-resident agents.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

British Electrical Imports and Exports

The effects of the imposition of import duties is very marked in the March trade statistics published this week by the Board of Trade. Imports of electrical apparatus and machinery during March amounted to only £242,301, or £137,777 less than in the preceding month, while the total was actually £266,343 lower than in March, 1931. Electrical exports, on the other hand, at £839,782, showed an advance of £36,277 on the February figure, although they were £318,298 below the total for March, 1931. A more detailed analysis of the figures will appear in our next issue.

E.D.A. April Programme

Special attention is given in the April programme of the British Electrical Development Association to its campaign for the more general use of posters, and a selection of attractive designs dealing with spring cleaning are presented. A new 60 in. by 40 in. poster, which we illustrate, is also reproduced. This is an entirely new feature in the Association's publicity service, and the Rural Electrification Committee has given a great deal of attention to its production. The sheet is printed in nine colours. Particulars are given of the poster contract, under which the Association provides a regular seasonal supply. The window display for the month features bedroom and boudoir appliances. The E.D.A. local Press advertisements for April for the use of electrical traders deal with spring-cleaning, while attention is drawn to the new electric cooking poster stamp. A price list of the Association's publications is included.

The new E.D.A. poster

Steel Tube Cartel Renewed

The renewal of the International Steel Tube Cartel, in which British manufacturers are interested, has now been definitely decided on. There is no change of any consequence in the composition of the Cartel, but the British and American quotas have, it is understood, been slightly modified with a view to taking a more exact account of the situation in the British market.—*Reuter* (Brussels).

The Leipzig Spring Fair

In spite of the depressed state of trade throughout the world the amount of business transacted at the Leipzig Spring Fair greatly exceeded expectations. The total number of exhibitors was 7,622, only 15 per cent. fewer than in the preceding year. The general Sample Fair did not lose many of its exhibitors, but the Technical and Building Fairs suffered rather badly, owing chiefly to the condition of trade on the Continent. Czecho-Slovakia headed the list of foreign participators in the Fair with 282 exhibits, and Japan followed with 191. Great Britain was eleventh in the list with 28 firms. This Fair was also noteworthy for the fact that for the first time the British Government was represented, although the Dominions have taken part for several years. This year the Department of Overseas Trade arranged an attractive stand, and it is understood that the officials in charge of it are highly satisfied by the results.

Callender's Jubilee

Handsomely bound in red and gold and excellently illustrated and printed is the book which has been issued by Callender's Cable & Construction Co., Ltd., to tell "The Story of Callender's, 1882-1932." The subject was dealt with by us in last week's ELECTRICAL REVIEW, under the title "Callender's Jubilee." The book, which is now before us, tells a more complete story. It also has finely executed photographs of the late Mr. William Ormiston Callender, "the founder," of Sir T. O. Callender, "the maker" of the company, and of many other gentlemen who have been associated with the business during its fifty years. Numerous pictures showing cable contracts in course of execution in many cities here and overseas, for lighting and power work, for railway electrification, for tramways, for overhead and submarine power transmission, and so forth, are distributed throughout the book. Two pages of another kind are particularly interesting; one reproduces the signatures of the original subscribers to the company in 1882; the other is a collection of autographs of the founders of the Cable Makers' Association (including Sir T. O. Callender) on the menu card of the dinner held on January 10th, 1900, which resulted in the practical development of the Association. If we may single out one more from among so many interesting parts, let it be the photographic group of the directors and management of the company at Erith works in 1896, for this seems to carry one back into the atmosphere of quite other days and to encourage the mood of reminiscence.

American Company's Employé-Shareholders

Approximately 34,000 employés of the General Electric Co., of New York, are holders of employés securities corporation bonds of a face value of $39,000,000, according to the ninth annual report of the company. During 1931 the company was favoured by the sustained income of electric lighting and power companies and the maintained dividends upon their securities, in which the bulk of its funds is invested; also by large reserves accumulated from sales made at a profit in earlier years. It is remarkable that in a year of unemployment and part-time employment, investments in bonds by employés should have exceeded redemptions. The average holding of bonds by employés is shown by the report to have been $1,164 during 1931, and the average amount paid to bond holders as interest was $91.94. The bonds of the corporation bear interest at the rate of 6 per cent., the General Electric Company of New York adding 2 per cent. as long as the bond holders remain employés of the company.

Compensation for Greenock Electricity Workers

As a result of a claim of the National Union of General and Municipal Workers and others against Greenock Corporation for compensation on behalf of a number of members displaced from their employment at the Dellingburn power station at the beginning of last year, Sir Harold Morris, K.C., the arbitrator, has awarded the Union compensation amounting to £2,700, in addition to other minor awards. The Union is also pursuing the claims of other members who have been displaced by the grid scheme.

Overhead Line Protection

Referring to Mr. D. A. Bower's article on the E.A.G.W. surge absorber in our issue of April 1st (p. 485), the Anglo-Swiss Electrical Co., Ltd., informs us that it is the sole agent in this country for the surge absorber described.

Messrs. Isenthal & Co., Ltd., state that they have been supplying a very similar arrester to the one described by Mr. Bower for some time past.

E.D.A. Luncheon at Manchester

Mr. J. H. Farthing, chairman of the Area Committee, presided at last week's luncheon of the North-Western Area of the British Electrical Development Association. The principal speakers were Mr. C. H. Cox, chairman of the E.D.A. Council, Mr. A. C. Cramb, director and secretary, Alderman W. Walker, chairman of the Manchester Electricity Committee, the Mayor of Salford and Mr. H. C. Lamb, the Manchester city electrical engineer. We have received a copy of the annual report which was presented at this meeting, showing that there was great activity in the area last year. It was mentioned at the meeting that the North-Western Area is the largest of the E.D.A. sections.

The E.D.A. April window display

Traffic Signal Demonstrations

The accompanying illustration shows one of several demonstration cars now being placed in service by the Automatic Electric Co., Ltd., for the purpose of demonstrating to traffic authorities throughout the country, in their respective districts, the advantages of the A.T.M. " Electro-matic " traffic signals, the vehicle-operated system which was recently inaugurated

One of the " Electro-matic " demonstration cars

in the City of London. Each car is fully equipped with standard signal lanterns, controller, and detector pads, enabling actual traffic conditions to be simulated, and the signals operated accordingly, at any point, and at short notice. Facilities are available for comparison with rival systems.

Yarrow Boilers for the Merchant Service

During the last five years boiler installations designed by Messrs. Yarrow & Co., Ltd., to the extent of over 3,000,000 sq. ft. heating surface have been built for the Merchant Service. Among the newly built British liners equipped with Yarrow boilers are all the C.P.R. " Duchess " vessels, the *Empress of Japan*, *Empress of Britain*, all the latest P. & O. liners, including the *Viceroy of India*, *Corfu*, *Carthage*, *Strathnaver* and *Strathaird*, and the C.N.R. " Prince " ships. Yarrow boilers have also been chosen for the new Cunarder. Long term licences to manufacture the latest forms of " Yarrow " high-pressure water-tube boilers have just been granted to Messrs. William Denny & Bros., Ltd., the Wallsend Slipway & Engineering Co., Ltd., and Hawthorn, Leslie and Co., Ltd.

Social Events

On April 8th, the St. Pancras Borough Council electricity staff held a social evening and concert which served the dual purpose of inaugurating a sports and social club for the Department and also of affording an opportunity for the recently appointed chief electrical engineer, Mr. Robert Lee, to meet his staff collectively. Mr. Lee, who took the chair, expressed his best wishes for the Sports and Social Club's success. Mr. W. J. Lee, on behalf of the Sports Committee, tendered his thanks, and outlined the various sporting and social activities which the club hoped to cover. A programme of music and dancing followed.

On Thursday and Friday last the G.E.C. Dramatic Society presented " The Sport of Kings " at the Guildhall School of Music Theatre, in aid of the Infants' Hospital, Westminster. This well-known farce by Ian Hay never fails to amuse, and it was admirably acted by a strong company. It was preceded by a " curtain raiser " entitled " In the Tunnel," with which the Society reached the London final of the British Drama League Festival, 1932. This playlet depicts a train entombed in the Channel Tunnel, and shows how the knowledge of their doom affects six of the passengers. The climax requires skilful handling, and the company, with the aid of G.E.C. lighting effects, gave a realistic performance. The Society's performances for the Infants' Hospital have become an annual event, and judging from the large audiences and the donations received the Hospital will benefit substantially.

Over 160 people attended the annual supper ball of the Southend branch of the Electrical Contractors' Association which was held at the Palace Hotel. Mr. H. J. Bell presided at the supper, supported by Mrs. Bell and Ald. R. Tweedy Smith. Mr. C. Jones, proposing " The Southend Branch," made an appeal to the Southend Corporation to do its utmost to set up a joint development committee. The contractors would do their part in co-operating with the Corporation for the good of the consumers. Mr. Bell, responding, said that until last spring they were only a branch of the Chamber of Trade, but since that time they had become a branch of the national body. They were all approved contractors to the Corporation under the assisted wiring scheme. In this matter they felt that they were not being dealt with in a fair and reasonable manner as they could only approach the Electricity Committee by means of a joint development committee. Ald. Tweedy Smith proposed the visitors' health and Major K. Taylor responded.

We always expect a good show from Henley's Dramatic Club and are never disappointed. This reputation was maintained on Monday evening last when the Club staged " The Middle Watch " by Ian Hay and Stephen King-Hall at the Cripplegate Theatre. The comedy gave full scope to the talents of the company, although " uniformed " plays are not too easy of performance. We award special bouquets with great reluctance, but Mr. Hugh Stanley's *Marine Ogg* was a masterpiece of anguished anxiety and injured propriety, and Miss Hilda Starbuck, as *Mary Carlton*, was vivacious and charming; her one pathetic interlude was very well done. Messrs. R. K. Edney, W. G. Turner and F. S. Bettley were excellent as a commander, captain and admiral respectively, and the Misses Edith Wade, E. Hannon, K. Thurgood, and H. Sneddon filled the female rôles with their usual distinction. Praise must also be accorded to the rest of the company, Messrs. J. Ahern, R. Almand, J. Hancock, E. W. Catford, and S. E. Tarling, and Miss Joan Earl. The play was produced by Mr. H. Thornton, and Mr. R. H. Edmead acted as stage manager. Interval music was provided by the " Troilus Five."

A " Chloride " Training Scheme

Excellent results have been achieved by the Chloride Electrical Storage Co.'s scheme instituted in 1927 for the training of " recruits " for its organisation, and the company is already reaping a rich reward in increased efficiency in all departments. The scheme is based in the first place on a careful selection of human material, and the 17-year-old candidates (who must have a matriculation certificate or its equivalent) have to satisfy a committee, by personal interview, that they are likely to benefit by the special training offered. No obligation of employment, at the end of the two years, rests on the company, and no " trainee " is bound to remain with the company after the period, but preference is given to the " trainees " for vacancies occurring in the organisation, and in practice it is found that demand and supply, in this particular case, practically balance.

Friction Tape Agreement

Rotunda, Ltd., has secured an exclusive licence from the Plymouth Rubber Co., Inc., Canton, Mass., U.S.A., to manufacture in this country its " Plymouth " black adhesive friction tapes and splicing compounds. The agreement covers the sale of these products in the British Isles, the British Dominions, and Europe, and while there is no exchange of shares or other such financial arrangement, the agreement provides for a considerable measure of co-operation between the two companies.

Recent Contracts

Orders executed by the Alton Battery Co., Ltd., include a battery for Turks Island for Imperial and International Communications, Ltd., ten batteries for the Irish Free State Posts and Telegraphs Department, stand-by batteries for emergency lighting at the Streatham, Peckham, and Hammersmith Gaumont cinemas, and a battery for Cupar radio station for the G.P.O. Engineering Department.

G.E.C. players in " The Sport of Kings "

The Edison Swan Electric Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., have received contracts from the Department of Local Government and Public Health, Dublin, for a twelve months' supply of electric lamps.

We have received from the Metropolitan-Vickers Electrical Co., Ltd., some particulars of rotary convertor contracts which the company has in hand in connection with the frequency change-over. These include rotary convertors together with transformers designed to operate from a 3-phase, 50-cycle, 10,750-V supply to replace Metro-Vick plant at present installed at Tynburn Road and Chester Street sub-stations of

Birmingham Corporation and two 1,500-kW and three 500-kW rotary convertors ordered by the London Electric Supply Corporation for the Bermondsey Borough Council sub-stations at Neckinger, Almond Street, and Silver Street. This contract also includes transformers to operate at 50 cycles, 3-phase, 6,600 V, and l.p. starting panels.

The Danish Government has just placed an important order with Standard Telephones & Cables, Ltd., for a new broadcasting station for Kalundborg. The station will have a carrier power of 60 kW, increased by modulation to 100 kW, and will operate in the 1,100-metre waveband. The equipment, which will be manufactured in the company's London factories, will be put into service early next year.

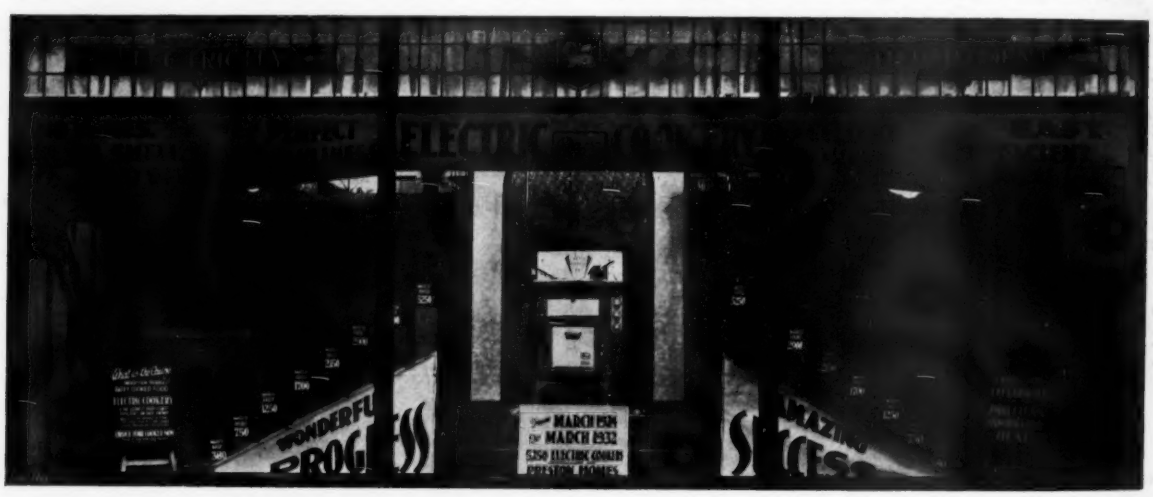
Siemens Electric Lamps & Supplies, Ltd., have received a contract from the Admiralty for a supply of gasfilled and vacuum lamps for ship lighting.

Australian Radio Regulations

H.M. Trade Commissioner at Melbourne has forwarded to the Department of Overseas Trade a copy of amendments to the "Wiring Regulations" which have been issued by the State Electricity Commission of Victoria in consequence of the rapid extension of the use of radio receiving sets operated from electricity supply mains. The regulations will not be applied to sets already in use unless the Commission gains evidence that any set is in a dangerous condition, when it will insist upon reconstruction. All new sets, however, must comply with the new regulations. A copy of the regulations is available for loan on application to the Department, 35, Old Queen Street, S.W.1.

Cooker Progress at Preston

Having installed 5,250 electric cookers during the past eight years, Preston Electricity Department may well be proud of its achievements, and a special window display has been prepared at its offices depicting the various stages of its progress. As will be seen from our illustration, the centrepiece



A special window display showing the progress of electric cookers in Preston

of the display is a "Revo" cooker, on each side of which is a flight of eight steps, each one representing a year in the history of the Department. On the steps are cards bearing the number of cookers installed in Preston at the end of each twelve months.

The Indian Import Market

A Department of Overseas Trade survey of the import trade of India during the nine months ended December 31st last states that for the first time the value of the exports from India to the United Kingdom (Rs.35 crores) was greater than imports from the United Kingdom (Rs.32¾ crores). Total imports of machinery declined from Rs.10,90 lakhs to Rs.8,34 lakhs, the British share being reduced from Rs.8,19 lakhs to Rs.5,69 lakhs. Electrical machinery imports fell from Rs.1,75½ lakhs to Rs.1,52 lakhs, although purchases from the United States were increased from Rs.19 lakhs to Rs.29 lakhs. Trade in the electrical instrument market (covering telegraph and telephone apparatus), which in 1930 amounted to Rs.2,20 lakhs, was reduced to Rs.1,78 lakhs in the period under review. Imports from the United Kingdom fell from Rs.1,25 lakhs to Rs.89 lakhs and those from the United States from Rs.31 lakhs to Rs.27½ lakhs. Radio apparatus imports rose from Rs.4¼ lakhs to Rs.6¼ lakhs, and it is encouraging to note an advance in the British share from Rs.2¼ lakhs to nearly Rs.4 lakhs.

For Sale

Barnes Urban District Council has a 600-kW steam engine, dynamo, &c., for disposal.

Hants County Council has electrical plant for disposal.

Fuller, Horsey, Sons & Cassell will sell electrical plant and general stores by auction on May 6th.

(See our advertisement pages to-day.)

New Australian Broadcasting Company

A new company, entitled the Goulburn Broadcasting Co., Ltd., has been registered in Sydney with a capital of £4,000 for the purpose of operating a broadcasting station in New South Wales.

The Marking of Abrasive Wheels, &c.

The Board of Trade announces that a draft Order-in-Council was laid before Parliament on April 6th, requiring imported abrasive wheels, cylinders, cups, cones, discs, rollers, blocks, bricks, stones and sticks to bear an indication of origin on sale or exposure for sale in the United Kingdom. The Draft Order is being published and copies will be obtainable shortly from the Stationery Office.

The Standing Committee (General Merchandise) has reported on its inquiry as to whether imported abrasive cloth and paper should be required to bear an indication of origin. Copies of the report (Cmd. 4049, price 1d.) may be obtained from the Stationery Office.

German Electrical Imports and Exports

The imports of electrical machinery, apparatus, and cognate goods into Germany during January last attained a value of £123,600, as compared with £189,500 in the first month of 1931. The exports of similar material declined from £2,205,500 to £1,671,350.

The Timber Market

Our Timber Trade Correspondent reports that all sections of the timber market have been dull during the past month. Stocks of building woods generally are of more moderate volume compared with a year ago, but demand has been weak. Hardwoods for cabinet and furniture work also are in slow request, with stocks moderate compared with last year, yet ample at present rates of demand. The 10 per cent. duty does not induce British importers to buy largely of foreign wood, while American and Canadian timbers also are affected by the high value of the dollar compared with the pound. When manufacturing revives the Empire woods, especially mahogany, will be in larger demand than previously. Plywood is in large stock in the country, particularly that of the inferior varieties.

Trade Announcements

The Henderson Electrical & Wireless Service, Brighton and Worthing, has been appointed sole agent for "Silvertown" cables and flexibles for the following territory—Bognor, Brighton, Eastbourne, along the coast to Margate, Herne Bay, Whitstable, Rochester, Sevenoaks, East Grinstead, Crawley, Guildford, Hindhead, and Midhurst.

The telephone number of Messrs. J. G. Statter & Co., Ltd., 16, Great George Street, S.W., has been changed to Whitehall 3030.

The F.B.I. Annual Review

In a review of the present position of industry Sir James Lithgow, the retiring president, stated at the annual general meeting of the Federation of British Industries yesterday that future students of British history might well draw a close parallel between the years 1914 and 1931. In 1914, after the first shock of surprise, the people generally failed to appreciate the magnitude of the task ahead, and the Government of the day either made a similar miscalculation or feared to take the nation sufficiently into its confidence. The crisis of 1931 likewise demanded strenuous, prolonged and general effort. The National Government had not been slow to grasp the danger of the situation, and to take at least preliminary steps towards remedying it. The country had also given ample proof that it was prepared to play its part in supporting a policy of return to the straight and difficult paths of financial rectitude and assiduous industry. This resolute attitude of the British people had already gone far towards the re-establishment of British prestige abroad.

Hackbridge Transformers for Canada

This week the Hackbridge Electric Construction Co., Ltd., is shipping nine 18,750-kVA transformers to Canada, the balance of an order for 25 received two years ago. Our picture shows these transformers *en route* to the docks. This is claimed to be the largest order for industrial transformers ever placed in

Nine 18,750-kVA "Hackbridge" transformers on their way to Canada

Great Britain, and at the time of ordering they were the highest voltage power transformers ever manufactured in this country (154,000 V). The units have to work outdoors under temperature conditions varying between minus 40 deg. and 104 deg. F. Each unit weighs 65 tons. At the end of last year, the company was awarded a contract by the County of London Electric Supply Co., Ltd., covering the construction of two 93,750-kVA three-phase transformers for Barking "B" generating station. These, the company states, are the largest power transformers in the world, and when complete will weigh about 150 tons each.

New Showrooms for Rawtenstall

Rawtenstall Corporation is calling for tenders for the erection of electricity showrooms at Bank Street.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, Etc.	Price April 13th.	Fortnight's Inc. or Dec.
[a] Acid, Oxalic .. .. per lb.	5½d.	—
[a] Ammoniac, Sal .. .. per ton	£60	—
[a] Ammonia, Muriate (large crystal)	£52	—
[a] Borax	£17	—
[a] Copper Sulphate	£25 10s.	—
[a] Potash, Chlorate .. .. per lb.	3¾d. to 4¼d.	—
[a] ,, Perchlorate	5½d.	—
[a] Shellac T.N. .. .. per cwt.	£3 15s.	—
[a] Sulphur Commercial	£11	—
[a] ,, Roll	£11	—
[a] Soda, Chlorate .. .. per lb.	3¼d. to 3½d.	—
[a] ,, Crystals .. .. per ton	£5 to £5 5s.	—
[a] Sodium Bichromate, casks .. .. per lb.	4d.	—
METALS, Etc.		
[b] Aluminium, Ingots .. .. .. per ton	£95 to £100	—
[b] ,, Wire .. .. per lb.	1/1 to 1/9	—
[b] ,, Sheet and Foil .. .. .. ,,	1/1½ to 2/9	—
[f] Babbits Metal and Anti-friction Metals—		
Grade I .. .. .. per ton net	£102	£21 dec.
Grade II .. .. ,,	£76	£13 dec.
Grade III .. .. ,,	£48	£5 dec.
[c] Brass (rolled metal 2" to 12" basis) .. per lb.	7d.	½d. dec.
[c] ,, Tubes (solid drawn) .. .. ,,	9d. to 9½d.	½d. dec.
[c] ,, Wire, basis .. .. .. ,,	7½d.	½d. dec.
[c] Copper Tubes (solid drawn) .. .. ,,	9½d.	½d. dec.
[f] ,, Bars (best selected) .. .. per ton	£63	£3 dec.
[f] ,, Sheet .. .. ,,	£63	
[f] ,, Rod .. .. ,,	£63	
[f] ,, (Electrolytic) Bars .. .. ,,	£38	—
[d] ,, ,, Sheets .. .. ,,	£68	—
[d] ,, ,, Wire Rods .. .. ,,	£42	—
[d] ,, ,, H.C. Wire .. per lb.	6½d.	—
[f] Ebonite Rod .. .. ,,	1/3 to 1/6	—
[f] ,, Sheet .. .. ,,	1/3 to 1/6	—
[a] German Silver Wire .. .. .. ,,	2/2	—
[h] Gutta-percha, fine .. .. .. ,,	nom.	—
[h] India-rubber, Para fine .. .. .. ,,	3½d.	—
[i] Iron, Pig (Cleveland No. 3) .. .. per ton	58/6	—
[i] ,, Wire, galve. No. 1, P.O. qual. ,,	£20	—
[g] Lead, English pig .. .. .. ,,	£13	10s. dec.
[g] Mercury .. .. per bot.	£17 10s.	15s. dec.
[e] Mica (in original cases) small .. per lb.	6d. to 3/6	—
[e] ,, ,, medium .. ,,	4/- to 8/-	—
[e] ,, ,, large .. ,,	8/6 to 17/6 & up	—
[b] Phosphor Bronze, plain castings .. ,,	1/1½d.	—
[b] ,, ,, drawn bars & rods ,,	11d.	—
[b] ,, ,, rolled strip & sheet ,,	10½d.	½d. dec.
[b] ,, ,, wire .. .. ,,	1/-	½d. dec.
[o] Platinum .. .. per oz.	£10 3s. 6d.	9s. 6d. dec.
[d] Silicium Bronze Wire .. .. .. per lb.	7½d.	—
[r] Steel, magnet, in bars .. .. .. ,,	7½d.	—
[g] Tin, Block (English) .. .. .. per ton	£104 10s. to £106 10s.	£15 dec.
[n] ,, Wire, Nos. 1 to 16 .. .. per lb.	3/1	—

Quotations supplied by:—

[a] G. Boor & Co.
[b] The British Aluminium Co., Ltd.
[c] Thos. Bolton & Sons, Ltd.
[d] Frederick Smith & Co.
[e] F. Wiggins & Sons.
[f] India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
[g] James & Shakespeare.
[h] Edward Till & Co.
[i] Bolling & Lowe.
[j] Richard Johnson & Nephew, Ltd.
[n] P. Ormiston & Sons.
[o] Johnson, Matthey & Co.
[p] C. Clifford & Son, Ltd.
[r] W. F. Dennis & Co.

New Catalogues and Lists

George Cohen, Sons & Co., Ltd., Park Royal Road, North Acton, N.W.10.—An illustrated catalogue of the company's machine tools.

Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4.—Publication No. L753, relating to "Ediswan" lamp price reductions. Also a leaflet (No. A.B. 761), illustrating the company's primary cells and batteries.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—Booklet No. 386, dealing with the automatic control of street lighting.

Brook Motors, Ltd., Empress Works, Huddersfield.—List No. 325, a 40-page price list of the company's standard motors of from ¼ h.p. upwards.

British Electric Transformer Co., Ltd., Wellington House, Strand, W.C.2.—A leaflet dealing with the "Tricity No. 9" all-chromium electric iron, and a folder relating to "Sunray" radiators.

Fry's (London), Ltd., 24-25, King Street, Minories, E.1.—Leaflet No. 5, describing "Enox" hack saw blades.

Leda Electric, Ltd., Nelson Street, Miles Platting, Manchester.—A leaflet describing the company's latest product—the "Leda" automatic electric refrigerator.

Marbourn, Ltd., 120, Pratt Street, Camden Town, N.W.1.—Leaflets Nos. 1 and 2, dealing respectively with slow make and break accessories, and quick make and break switches and switch plugs.

Joshua Rea & Sons, Ltd., Collingwood Street Oil Works, Liverpool.—Particulars of "Siola" turpentine and "Senga" bitumen varnish paint.

Display Craft, Ltd., 68, York Road, Waterloo, S.E.1.—A leaflet relating to cube fittings, etc., for shop-window decoration purposes.

Hugh J. Scott & Co. (Belfast), Ltd., Volt Works, Ravenhill Avenue, Belfast.—A folder providing in handy form particulars and prices of a complete range of "Scott" motors and generators.

British Insulated Cables, Ltd., Prescot, Lancs.—A revised bell-wire price list (No. P.F.86).

British Thomson-Houston Co., Ltd., Rugby.—Several illustrated leaflets relating to switchgear, circuit breakers, power transformers, synchronising relays, earthing resistances, tram-car controllers, &c.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—April stock list of electric motors, dynamos, transformers, &c.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—List No. 1239A, giving illustrations, particulars and prices of electrical fittings and accessories.

Bankruptcy Proceedings

Emma M. Barker and **H. D. Stillwell** (trading as "Berks Electrical Co."), electrical and wireless engineers, 14, Cross Street, Reading, Berks.—The public examination took place recently at the Assize Courts, Reading. A statement of affairs had been lodged showing gross liabilities of £844, of which £596 was expected to rank for dividend. The assets were estimated to realise £365, so that there was a deficiency of £231. The failure was attributed to "insufficient trade to guarantee the drawings and expenses." The examination was adjourned.

L. C. Shearley, electrical contractor, 2a, Dornberg Road, Blackheath, S.E.—First meeting April 18th at 29, Russell Square, W.C. Public examination May 17th at the Court House, Greenwich, S.E.

C. A. Brown, wireless and electrical engineer, 36, Leagrave Road, Luton.—First meeting held April 13th. Public examination May 20th at the Court House, Luton.

C. D. Bruce, electrical engineer, 67, Bold Street, Altrincham.—First meeting held April 13th. Public examination May 27th at the Court House, Quay Street, Manchester.

W. E. Bowles ("Electrocrafts"), electrical engineer and wireless dealer, 5, Bellevue Parade, Wandsworth Common, S.W.—First meeting April 18th at 29, Russell Square, W.C. Public examination May 12th at the Court House, Wandsworth.

J. Owen (J. Owen & Sons), electrical engineer, 186, Westcombe Hill, and 3, The Grove, Greenwich, S.E.—Application for discharge to be heard April 29th at the Court House, Burney Street, Greenwich, S.E.

W. A. Hunt (Celtic Radio), wireless engineer, 36, Wharf Street, Leicester.—Receiving order made April 4th on debtor's own petition. First meeting April 18th at the Official Receiver's office, 1, Berridge Street, Leicester. Public examination May 6th at the Castle, Leicester.

R. Dring, electrical engineer, 257, Freeman Street, Great Grimsby.—Application for discharge to be heard May 11th at the Town Hall, Great Grimsby.

W. F. O. Sewell (Commercial Electrical Co.), electrical engineer), 24, James Street, Bradford.—Supplemental dividend of 2s. 6d. in the £, payable April 15th at the Official Receiver's office, Hallfield Chambers, 71, Manningham Lane, Bradford.

Company Liquidations

H. C. Siddeley & Co., Ltd.—Meeting of creditors April 19th at 50, Queen Anne's Gate, S.W. Particulars of claims by April 16th to the liquidator, Mr. A. R. T. Rogers, 96, Leadenhall Street, E.C.

Walsall Electrical Co., Ltd.—Winding up voluntarily. Liquidator, Mr. P. Cozens.

Sphinx Electric, Ltd.—Last day for receiving proofs for dividend, April 20th. Liquidator, Mr. G. D. Pepys, 33, Carey Street, W.C.2, Senior Official Receiver.

A. I. Greenwood, Ltd.—Meeting May 10th at 99, Albion Street, Leeds, to receive an account of the winding-up by the liquidator, Mr. B. Armitage.

Wood Electric Fittings Co., Ltd.—Particulars of claims by May 13th to the liquidator, Mr. F. H. Agar, Pinners Hall, Austin Friars, E.C.

Tampico Electric Light, Power & Traction, Ltd.—Meeting May 10th at 47, Parliament Street, Westminster, S.W., to receive an account of the winding-up by the liquidator, Mr. J. S. Evernden.

Electricity Supply

Lighting, Domestic, Power

Abergavenny.—SUPPLY INAUGURATED.—A supply of electricity was switched on last Tuesday at Abergavenny by the Mayor. The ceremony marked the completion of a scheme to supply a large portion of South Wales and Monmouthshire, the new service operating over 398 miles of cables.

Ashford (Kent).—BULK SUPPLY.—In reply to the application of the Urban District Council for permission to install additional generating plant, the Electricity Commissioners have intimated that it would be in the interests of the Council and of the scheme for South-East England if a bulk supply were taken, and that they would favourably consider an application by the Council to establish a transmission line between the town and Folkestone. The Council last week approved this suggestion, and instructed the electrical engineer to commence the necessary negotiations.

MAINS EXTENSIONS.—The Council has applied to the Kent Electric Power Co. for consent to extend its mains to Olantigh (Wye), Hamstreet, Warehorne, Mersham, and Sevington, which are in the company's supply area.

Birkenhead.—MODIFICATION OF CORPORATION'S WIRING ACTIVITIES.—The Electricity Committee has decided, subject to confirmation by the Town Council, that the carrying out by the Electricity Department of any wiring in houses or factories, except under the assisted wiring scheme and the deferred payment system, and except work in Corporation property, shall be discontinued.

Blackburn.—EXTENSIONS.—The Electricity Committee has decided to proceed with the supply of electricity to 376 houses on the Longshaw site, at an estimated cost of £6,605.

Blackpool.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at Poulton.

Burnley.—FLOODS INTERFERE WITH SUPPLY.—The electricity supply at Burnley was interfered with for a short time on April 7th as the result of the flooded state of the River Calder, from which the power station draws its supply of water for the condensers.

Canada.—THE BEAUHARNOIS CASE.—According to *The Times*, Mr. Ferguson, the former Premier of Ontario and now High Commissioner in London, in giving evidence at his own request before the Senatorial Committee of investigation, denied knowledge of any payment or contribution to the campaign funds of the Conservative Party by the Beauharnois Corporation in connection with the Ontario Hydro-electric Commission contract. Mr. Ferguson said he had seen Mr. Sweezey, the president of the Beauharnois Corporation, twice, but during those interviews no payment of money to Mr. Ferguson, or to the campaign fund, or as a donation to the Conservatives was ever mentioned. Mr. Ferguson had referred Mr. Sweezey to Mr. Magrath, the chairman of the Hydro-electric Commission, respecting the contract for 250,000 h.p. The Senatorial investigation is now complete. The committee was concerned only with evidence reflecting upon the honour of the three Liberal senators who were censured by the investigating committee of the House of Commons last July.

Cardiff.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at Pengam and Ely at a cost of £1,010.

Carlisle.—NEW CABLES.—The Electricity Committee is to lay mains in the Longtown and other areas at a cost of £2,803.

Chesterfield.—MAINS EXTENSIONS.—Cables costing £3,388 are to be laid by the Electricity Committee in Grassmore Village.

Chichester.—CONCESSION TO FARMERS.—The City Council has decided to supply electricity for poultry-rearing, flood-lighting of gardens, and garden heating at 1d. per kWh in the city, and at 1½d. per kWh outside. A two-part tariff is to be adopted subject to the approval of the Electricity Commissioners.

BULK SUPPLY.—Portsmouth Corporation is to give a bulk supply to Chichester.

FUTURE OF UNDERTAKING.—A proposal to dispose of the undertaking to the Mid-Southern District Utility Co. is to be considered by the full Council.

Coatbridge.—FUTURE SUPPLY.—Mr. T. D. King Murray, who was appointed by the Town Council to act as referee on the offers by the Coatbridge and Airdrie Electric Supply Co., Ltd., and the Clyde Valley Electrical Power Co. for the new contract for supplying electricity in Coatbridge, reports that he is definitely of the opinion that the offer by the Clyde Valley Co. is to be preferred.

Easingwold.—CHANGE-OVER COMPLETED.—The change-over of the electricity supply from the generating station of Messrs. J. C. Bannister & Co. to the Cleveland and Durham Electric Power Co., Ltd., is now in operation. Messrs. Bannister and Co. were the pioneers of electric lighting at Easingwold, where it was first installed in 1925.

Eastbourne.—SUPPLY IN WINKNEY FARM AREA.—The Electricity Committee is negotiating with the Central Electricity Board with regard to a grid supply for the Winkney Farm Estate.

Eccles.—CHANGE-OVER.—The borough electrical engineer has been empowered to make arrangements for the immediate change-over of consumers in the Church Street area to the standard pressure of supply.

Gillingham (Kent).—LOANS.—The Electric Light Committee recommends that application should be made for sanction to the following loans:—Mains and services, £18,000; sub-station equipment, £2,000; wiring schemes, £2,500; consumers' apparatus, £2,500.

Gower (Glam).—PROSPECTS OF A SUPPLY.—The South Wales Power Co., Ltd., is shortly to commence the laying of cables to supply the Gower Peninsula. Penclawdd and Three Crosses will be among the first places to secure supplies.

Hastings.—STREET LIGHTING IMPROVEMENTS.—The Electricity Committee has prepared a scheme of street lighting improvements costing £4,873.

EXTENSIONS.—A sub-station is to be provided at London Road, St. Leonards, at a cost of £1,350. The Electricity Committee is also to extend cables and erect a transformer kiosk at a cost of £965 to meet the increasing load at Rye.

LOAN.—Sanction to a loan of £5,000 for excess expenditure (£1,717) and prospective expenditure on sub-station equipment has been applied for.

Irlam and Cadishead.—SUPPLY INAUGURATED.—The official inauguration of the electricity supply was performed last Friday by Mr. W. Wardle, vice-chairman of the Stretford and District Electricity Board. The scheme has cost £103,000.

Japan.—AUTOMATIC SYSTEM ADOPTED.—The Daido Power Co. has decided to introduce automatic operation at its Tokise power station, with a probable extension of the system to its other stations later. The work will be started in July.

Liverpool.—LOAN.—Application is being made for sanction to the borrowing by the City Council of £30,000 for the provision of mains, switchgear, and plant.

London.—SOUTHWARK.—The Electricity Committee proposes to introduce an all-in rate with a minimum quarterly charge of 14s. up to 1,000 ft. of floor area.

HAMPSTEAD.—The expenditure of £16,210 on cables, transformers, sub-stations, and general extensions, &c., is recommended by the Electricity Committee.

WOOLWICH.—The Borough Council has decided to supply electricity to small houses in North Woolwich.

Loughborough.—EXTENSIONS.—The Leicestershire and Warwickshire Electric Power Co. is to extend cables to supply the villages of Burton-on-the-Wolds, Hoton and Wymeswold.

Maidstone.—GRID SUPPLY PREPARATIONS.—The Town Council has applied for sanction to a loan of £10,910 for switchgear, &c., in connection with a supply of electricity from the grid.

Manchester.—PROGRESS DURING FEBRUARY.—During the month of February the City Electricity Department showed an increase of 4,754 kW in connections, bringing the total up to 477,187 kW. Applications for supplies, including additional supplies, totalled 1,790, representing 4,206 kW. There were 200 new cookers installed, making a total of 9,182 on circuit, while orders received for cookers amounted to 272. Three new sub-stations were put into commission, and new plant was installed at the Co-operative Society's sub-station in Downing Street.

New Zealand.—WAITAKI SCHEME DELAYED.—Floods on the Waitaki River and bad weather have delayed construction work on the Waitaki hydro-electric scheme to such an extent that it appears that the installation will not be completed until the middle of 1933, over six months later than the original estimate. At present the first half of the dam is being built to its full height, and the construction of the power house is proceeding steadily.

Northern Ireland.—NEWTOWNARDS.—The Rural District Council is considering the introduction of electric lighting in Groomsport and Millisle.

Peterborough.—MAINS EXTENSIONS.—Mains extensions costing £300 are to be carried out by the Electricity Department in Farcet Road.

Plymouth.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains to the Barne Barton Estate at a cost of £2,294.

Port Dinorwic.—SPECIAL ORDER.—The Electricity Distribution of North Wales and District, Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to purchase a portion of Port Dinorwic electricity undertaking and to supply electricity in parts of the parishes of Pentir, Llanfairisgaer and Llanddeiniolen.

Ross-shire.—EXTENSIONS.—The Ross-shire Electric Supply Co., Ltd., is to afford a supply of electricity to the districts of Munlochy, Avoch, Fortrose, and Rosemarkie.

Rugeley (Staffs).—SUPPLY TO COUNCIL HOUSES.—The Urban District Council has granted permission to the Trent Valley and High Peak Electricity Co., Ltd., to install electric lighting in Council houses on the Sandy Lane housing site.

Sunderland.—NEW SUB-STATION.—The Corporation has received sanction to a loan of £2,633 for the erection and equipment of a sub-station in Mary Street.

Swindon.—CHANGE-OVER.—The Electricity Committee is applying for sanction to a loan of £13,000 in connection with the change-over of the supply in the Rodbourne area from d.c. to a.c.

Wallsend-on-Tyne.—LIGHTING OF COUNCIL HOUSES.—The Newcastle-upon-Tyne Electric Supply Co., Ltd., is to install electric lighting in the Council's houses in Station Road and Prince Road.

STREET LIGHTING.—The Town Council is to light West Street by electricity and is obtaining quotations for the work.

Weybridge.—STREET LIGHTING CONVERSION.—The Urban District Council has decided to use electricity for street lighting in place of gas. The London & Home Counties Joint Electricity Authority is to be requested to undertake the conversion forthwith.

Whitstable.—OVERHEAD LINE.—The Whitstable Electric Co., Ltd., proposes to erect an overhead line along the Herne Bay-Whitstable Road between Chesterfield Halt and Kite Farm, Swalecliffe.

Wolverhampton.—SUPPLY IN UPPER PENN AREA.—An agreement has been reached for the purchase by the Town Council of that portion of the undertaking of the Midland Electric Corporation for Power Distribution, Ltd., situated in the areas to be added to the borough (*viz.*, the existing parish of Upper Penn), together with a sub-station in Coton Road. The purchase price agreed upon is £39,500.

SUPPLY TO HOUSING ESTATE.—The Electricity Committee is to provide a supply to the Heath Town Estate at a cost of £930.

BULK SUPPLY.—Arrangements have been made for a bulk supply to the premises of the Willenhall Motor Radiator Co., Ltd., at Bushbury.

Worthing.—ELECTRICAL DEVELOPMENT.—The Town Council has applied for sanction to a loan of £6,233 for the development of the electricity supply in Rustington, Angmering, and Durrington, and to effect a change of system in part of Broadwater.

York.—RURAL ELECTRIFICATION.—A supply of electricity has now been made available for the villages of Great Ouseburn, Little Ouseburn, and Whixley. The Corporation's rural electrification scheme will shortly be extended to Great Hammerton, Kirk, Hammerton, and Nun Monkton.

Traction

Barrow-in-Furness.—TRAMWAY ABANDONMENT.—Buses were substituted for trams in Barrow last week.

Birmingham.—TROLLEY BUS OPERATION.—Eleven of the original trolley buses on the Nechells route which were placed in operation in 1922 have now been replaced by modern vehicles, and the Transport Committee has decided to purchase five additional six-wheel trolley buses to replace the remainder of the old vehicles. These will have seating capacity for 56 passengers and will enable valuable experience to be obtained as to the operation of vehicles with a seating capacity more nearly approximating that of tramcars in view of the possibility of their substitution for tramcars on certain routes at some future date.

Blackburn.—THE FUTURE OF THE TRAMS.—Mr. Cowell, the Corporation transport manager, is preparing a special report concerning the advisability or otherwise of changing over from trams to buses.

Burnley.—BUSES REPLACE TRAMS.—The substitution of omnibuses for trams on the Rosegrove-Harle Syke route took place recently.

L.M.S. Railway.—CLOSING OF CLIFTON POWER STATION.—The London Midland and Scottish Railway Co. has decided to close down its Clifton power station which supplies the Manchester-Bury line. A supply will be taken from the Lancashire Electric Power Co. and this will entail a change-over from 25 to 50 cycles.

London.—TRAFFIC CONTROL CONFERENCE.—A meeting of representatives of the Metropolitan Borough Councils and the Minister of Transport was held at Westminster City Hall last week to consider the extension of the use of automatic traffic signals in London.

Traffic Control.—NEW INSTALLATIONS.—It is proposed to install automatic traffic control signals at the following places: Royal Oak corner, Keswick; Northumberland Street, Newcastle-on-Tyne; junction of Langworthy Road and Eccles Old Road, Salford; two junctions, Blackpool; three crossings, Macclesfield; and Malvern.

United States. — TRAMCAR IMPROVEMENTS. — High-speed "bullet"-type tramcars have recently been placed in service between Fonda, Johnstown, Gloversville, Amsterdam and Schenectady. They weigh less than half as much as the cars which they have replaced, and require only half as much electric power for operation. Higher running speeds are possible and the scheduled times of runs have been reduced by from 15 to 20 per cent. The five cars which have been placed in service were built by the J. G. Brill Co. of Philadelphia, and were electrically equipped by the General Electric Co. of New York. They seat 48 passengers. Each car is equipped with four 50-h.p. motors, geared for a maximum speed of 60 m.p.h., and magnetic track brakes are employed in addition to air brakes. Acceleration at two m.p.h. per second is possible.

Communications

Argentina.—NEW WIRELESS STATION.—Buenos Aires is to have a new broadcasting station, which will be constructed at the Marconi works at Chelmsford. Incorporating all the latest developments, including crystal and valve frequency control and low power modulation, the new station will be operated by Radio Excelsior of Buenos Aires on a power of 20 kW. It is expected to commence regular transmission early next year.

Australia.—ALLOCATION OF RADIO LICENCE FEES.—In reply to a question in the House of Representatives the Australian Postmaster-General said that in the year ended June 30th, 1931, the Australian Broadcasting Company received £186,949 from licence fees, Amalgamated Wireless, Ltd., £49,365, and the Commonwealth £146,673, making a total of £382,987. At the end of January last the total number of licences issued in Australia was 341,394.

Birmingham.—NEW TELEPHONE EXCHANGES.—Two new automatic telephone exchanges, known as Solihull and Calthorpe, were brought into service on Saturday last. The Solihull exchange has 1,300 lines and is capable of extension to 3,000 lines, while the Calthorpe exchange, located in Pershore Road, is equipped with 1,510 lines and has an ultimate capacity of 2,730 lines. The equipment in both exchanges was manufactured and installed for the General Post Office by Standard Telephones and Cables, Ltd.

Great Britain.—RADIO EXCHANGES.—The Hetton-le-Hole (Durham) Urban Council has asked its surveyor to report on a proposal of the Suburban Radio Relay Co., Ltd., Blackpool, to attach wires to the Council's electric light poles and houses for the purposes of a radio relay service.

The Redditch Highways Committee recommends granting permission to the Broadcast Listeners' Service, Ltd., to establish relay services.

The Plymouth Works Committee has been informed by the Wireless Retailers' Association that it considers it inadvisable

This sign, which has been erected in Trafalgar Square, London, is 110 ft. wide and 40 ft. high. "Claudegen" neon tubes are employed and an "Osram" photo cell automatically switches the sign on and off

for the Corporation to grant concessions to companies for relay systems now under consideration. The Committee has postponed its consideration of the matter pending the submission of tenders from the various applicants.

The Kent Relay Service Co. has applied to the Faversham Town Council for permission to install a service in the borough, and a committee has been appointed to discuss the proposals.

Italy.—A LINER'S WIRELESS EQUIPMENT.—The Italian liner *Comte Rosso* which left Trieste on April 12th for Shanghai is carrying the most powerful and modern c.w. telegraphic and telephonic apparatus so far used by passenger ships. According to *The Times*, three British engineers have been engaged with Italian experts at Trieste, in installing the apparatus, which is rated at 20 kW. They are to sail with the *Comte Rosso* in order to test the apparatus.

London.—TELEVISION.—The Baird Television Co. announces that the Postmaster-General has granted it a licence for the transmission of television by ultra-short waves.

Palestine.—TELEPHONY.—The first direct telephone conversation between Jerusalem and London took place on April 7th, when Mr. Royce Cudworth, Post Office engineer in Jerusalem, spoke to the Marconi telegraph office in London. Connection was made by way of land-line to Cairo and thence to London by radio.—*Reuter* (Jerusalem).

South Africa.—AUTOMATIC TELEPHONY.—A beginning is about to be made with the installation of automatic telephone exchanges in the Cape Peninsula, part of the equipment being now due to arrive. By the end of next year the automatic system is expected to be working in Cape Town, Sea Point, Camps Bay, Woodstock, and Rondebosch. Exchanges will lose their identity and the whole Peninsula will be worked on one series of numbers. At present there are only 17,000 telephones in the Peninsula, but provision will be made for 78,000 lines. It will take at least two years to complete the change.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Auchtermuchty (Fife).—April 25th. Town Council. Electric lighting for housing scheme. Messrs. James Gillespie & Scott, architects, St. Andrews.

Belgium.—IXELLES.—May 2nd. Hotel Communale. 1,300 d.c. electricity meters. Particulars (Cahier des Charges) from Le Service de l'Electricité, 20, Rue d'Alsace-Lorraine, Ixelles.

Carlisle.—April 22nd. Electricity Department. Cables. (April 8th.)

Dagenham.—Urban District Council. Cables, switchgear, overhead conductors, &c. (See this issue.)

Galloway.—May 2nd. Galloway Water Power Co. Hydraulically operated valves, &c. (April 8th.)

Farnworth.—April 29th. Electricity Department. L.p. cables. (See this issue.)

Glasgow.—April 23rd. Lighting Department. Twelve months' supply of electric fittings and accessories. Specs. from 20, Trongate.

Hastings.—May 11th. Electricity Department. Boiler fuel. (See this issue.)

Horsham.—May 9th. Electricity Department. Cables. (See this issue.)

Hull.—Corporation Telephones Committee. Private automatic telephone switchboard. (April 1st.)

April 19th. Electricity Department. H.p. and l.p. cables. (April 1st.)

Inverness.—April 26th. Electric lighting installation at new nurses' home and sanatorium to be erected at the Inverness District Asylum. Messrs. Alexander Ross & Son, architects, Queensgate Chambers, Inverness (deposit £1 1s.).

Kilmarnock.—April 21st. Town Council. Twelve months' supply of electric lamps for all Corporation Departments. Mr. W. Dunbar, burgh surveyor.

Langho (LANCS).—Lancashire Mental Deficiency Acts Committee. Overhead and underground line work for supplying the northern side of the estate at the Brockhall Institution. Messrs. Rees & Holt, architects, 64, Rodney Street, Liverpool.

London.—CENTRAL ELECTRICITY BOARD.—May 2nd. 33-kV and other cables for the South-West England and South Wales Scheme. (April 8th.)

OFFICE OF WORKS.—April 25th. Lamps. (See this issue.)

Manchester.—April 27th. Electricity Department. Cables, electrical equipment, and domestic appliances. (See this issue.)

Northern Ireland.—ELECTRICITY BOARD.—April 20th. L.p. distribution systems in a number of towns and villages. (March 18th.)

North-West Midlands.—April 25th. Joint Electricity Authority. E.h.p. and l.p. overhead transmission lines and outdoor type static transformers. (See this issue.)

Salford.—April 25th. Electricity Department. 12,500-kVA outdoor type transformer. (April 8th.)

Skipton.—April 25th. West Riding Education Committee. Electric lighting installation at Boys' Grammar School. Education officer, County Hall, Wakefield.

South Africa.—DURBAN.—May 16th. Electricity Supply Commission. 175-kVA transformer (A.X. 11313)* and turbo-generator with condensing plant (A.X. 11318)* for the Congella power station.

PIETERMARITZBURG.—May 19th. City Council. Meters (A.X. 11314)*, house service fuse boxes (A.X. 11315)*, insulated cable (A.X. 11316)*, lamps (A.X. 11317)*, and hard-drawn copper wire and insulated wire (A.X.11319)*.

CAPETOWN.—June 22nd. Electricity Department. Voltage regulators. (A.X. 11328.)*

May 18th. Electricity Department. Overhead line material and street lighting fittings. (G.X. 11372.)*

Warwickshire.—April 19th. County Council. Electric wiring at new nurses' home, County Mental Hospital, Hatton. A. B. Mallinson, consulting engineer, 44, Brazennose Street, Manchester.

Worthing.—April 19th. Town Council. Electrically driven pumps. Messrs. J. Taylor & Sons, Caxton House, Westminster (deposit £5).

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Barking.—Health Committee. Recommended. Electric clocks for isolation hospital (£28) and telephones and fire alarms (£235)—Siemens Bros. & Co., Ltd.

Blackburn.—Electricity Committee. Accepted. Meters.—Aron Electricity Meter. Ltd. Paper-insulated and armoured cables.—Edison Swan Cables, Ltd. V.i.r. wires and cables.—Derby Cables, Ltd.

Bradford.—Electricity Committee. Recommended. Provision of glass-bulb mercury-arc rectifier equipment and switchgear for traction sub-station, Pasture Lane, Clayton.—Hewittic Electric Co., Ltd.

Carlisle.—Electricity Committee. Accepted. Switchgear (£490).—Ferguson, Pailin, Ltd.

Cardiff.—Electricity Committee. Accepted. Two l.p. transformer control panels (£377), and four single panel switchboards (£89 each).—George Ellison, Ltd. Two e.h.p. metalclad transformer control panels (£442).—A. Reyrolle & Co., Ltd.

Chesterfield.—Electricity Committee. Accepted. Cables (£605).—Derby Cables, Ltd.

Dartford.—Electricity Committee. Accepted. Wiring at showrooms (£62).—E. E. Beaven. Platform lift (£59).—J. & E. Hall, Ltd.

Housing Committee. Recommended. Wiring 128 houses, Heath Lane estate.—Bexley Heath Electrical Co.

Dumfries.—Town Council. Cables (£145).—Johnson and Phillips, Ltd.

East Ham.—Electricity Committee. Recommended. Two feeder panels (£373) and duplicate busbar with selector gear (£600).—Switchgear & Cowans, Ltd. Accepted. Two switch panels for power station isolation hospital (£526 each).—A. Reyrolle & Co., Ltd.

Eccles.—Electricity Committee. Accepted. Transformer kiosk and switchgear (£235)—Drake & Gorham, Ltd.

Keighley.—Electricity Committee. Accepted. Cables for 12 months.—British Insulated Cables, Ltd. (A trial is to be made of cables offered by the Metropolitan Electric Cable and Construction Co., Ltd.)

Housing Committee. Accepted. Wiring 31 houses on the Broomhill estate (£133).—J. S. Ramsbottom & Co., Ltd.

Lanarkshire.—County Council. Accepted. Electrical work at forty-eight houses at Cleland (£206).—Colquhoun & M'Arthur.

Liverpool.—Electricity Committee. Recommended. 33,000-V cable, together with the necessary straight-through joints (£14,603).—British Insulated Cables, Ltd. Two booster regulators (£2,012), h.p. switchboard (£3,080), earthing transformers with the necessary switchgear (£591), and rearrangement of switchgear for an additional rotary convertor (£162).—Metropolitan-Vickers Electrical Co., Ltd. Two booster regulators (£2,083).—British Electric Transformer Co., Ltd.

Port Sanitary and Hospitals Committee. Recommended (subject to the approval of the Economy (Special) Committee, and the sanction of the Ministry of Health). Installation of electricity throughout the Belmont Road Institution (£3,970).—James Stott & Son, Ltd.

Manchester.—Electricity Committee. Accepted. 660-V paper-insulated, &c., cables (period ending June 30th, 1932).—Derby Cables, Ltd.; Metropolitan Electric Cable & Construction Co., Ltd.; Hackbridge Cable Co., Ltd.; Connollys (Blackley), Ltd.; Croydon Cable Works, Ltd.; Edison Swan Cables, Ltd.; Macintosh Cable Co., Ltd.; W. T. Glover & Co., Ltd.; Standard Telephones & Cables, Ltd.; Johnson & Phillips, Ltd. Static transformers (twelve months' requirements).—Metropolitan-Vickers Electrical Co., Ltd.

Plymouth.—Electricity Committee. Accepted. Cables for twelve months—British Insulated Cables, Ltd. Coal conveyor (£1,053)—New Conveyor Co.

Portsmouth.—Electricity Committee. Accepted. Cable.—Hackbridge Cable Co., Ltd. (£1,224); Metropolitan Electric Cable & Construction Co., Ltd. (£1,454).

Rotherham.—Electricity Committee. Recommended. Switchgear for 12 months.—A. Reyrolle & Co., Ltd.

Solihull.—G.W.R. Accepted. Installation of electrical signalling at station.—General Railway Signal Co., Ltd.

Torquay.—Electricity Committee. Accepted. Supplying and laying feeder cables from Newton Abbot to Torquay (£32,388).—Pirelli-General Cable Works, Ltd. Supply of 11,000-V and pilot cables to be laid between Lawes Bridge and Upton Valley (£3,640).—Union Cable Co., Ltd.

Wolverhampton.—G.W.R. Accepted. Eight 30-h.p. electric motors.—Electric Construction Co., Ltd.

Worthing.—Electricity Committee. Accepted. Cable laying, &c. (£6,927).—Callender's Cable & Construction Co., Ltd.

Forthcoming Events

Association of Supervising Electrical Engineers.—Tuesday, April 19th. Junior Institution of Engineers, London. 7.15 p.m. "Linking up of London Power Stations." Mr. J. D. Peattie.

Institution of Electrical Engineers.—Thursday, April 21st. Institution, London. 6 p.m. 23rd, Kelvin Lecture. "The Work of Oliver Heaviside." Dr. W. E. Sumpner. (*London Students' Section*).—Saturday, April 16th. 3 p.m. Visit to Croydon Aerodrome. (*North-Western Students' Section*).—Tuesday, April 19th. Annual general meeting. Engineers' Club, Manchester. 7.15 p.m. "Some Aspects of the British Grid." Mr. A. B. Stevenson. (*Sheffield Sub-Centre*).—Wednesday, April 20th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Latest Progress in Electric Traction." Mr. G. H. Fletcher. (*Irish Centre (Dublin)*).—Saturday, April 23rd. Faraday Lecture. "Everyday Uses of Electricity." Prof. J. K. Catterson Smith. (*South Midland Students' Section*).—Tuesday, April 19th. University, Birmingham. 7 p.m. Short papers.

Junior Institution of Engineers.—Friday, April 22nd. Hotel Metropole, S.W. Annual dinner.

Overhead Lines Association.—Wednesday, April 20th. Institution of Electrical Engineers, London. 5.30 p.m. Discussion on Overhead Line Regulations.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of the makers of the following:—

MONOLITE electric light fittings.
NIRVANA electric table lamp.
COLONIAL wire stripper.
SAIA electrically self-winding time switch.

Notes

The Heat Pump in a Large Building

THE heat pump, or reversed refrigerator cycle for the delivery of heat, which formed the subject of an I.E.E. paper by Mr. T. G. N. Haldane at the end of 1929 (ELECTRICAL REVIEW, December 27th, 1929), has now been in use for several months for heating the 13-storey office building of the Southern California Edison Co., Los Angeles. Operation results up to the middle of this winter, according to the *Electrical World*, show that for every kWh expended in the system 2.1 kWh has been liberated as useful heat. This figure could have been raised to 2.8 if a heater had been placed in the lower system, thus utilising its capacity more fully. The installation (which is also used to provide summer cooling) consists of four 120-ton compressors, each driven by a 200-h.p. synchronous motor.

Methyl chloride was chosen as the refrigerant in order to eliminate ammonia fumes and to enable rotary compressors to be used with lower pressures and freedom from vibration. The building has a content of 3¼ million cu. ft., and a gross floor area of 269,000 sq. ft. The combined capacity of the three systems is 193,000 cu. ft. per min., which provides six changes of air per hour.

An auxiliary system of 3.8-kW heaters (aggregating 1,589 kW) is installed in the air ducts. Temperature control is automatic in six ½-deg. steps, interlocked with the fan control. The heat pump and three auxiliary heaters warm the building in the morning, and keep the temperature of the air from falling below a pre-determined value. Final heating is obtained by thermostatically controlled direct units in each office, ranging from 1½ to 5 kW, and aggregating 1,329 kW in installed capacity. The engineers report that the heat pump has fulfilled all expectations, and believe that it has a great future for providing complete air conditioning in office and commercial buildings.

D.C. Power Transmission

We are asked to state that the paper which was referred to under the above heading on page 484 of our April 1st issue was submitted by Mr. Schölberg-Henriksen at the 1931 session of the International Conference on Large High-tension Electric Systems in Paris. Copies are obtainable from the secretary of the Conference, 54, Avenue Marceau, Paris, France, for 5 fr. each, printed in English.

Electrical Association for Women

About thirty members of the North-West Midlands Branch of the Association recently paid a visit to the generating station of the North-West Midlands Joint Electricity Authority, the Hanley sub-station, and the meter testing department of the Stoke-on-Trent Corporation. Tea was served in the superintendent's office, and a vote of thanks to Mr. Yeaman for arranging the visit was proposed by Alderman H. Leese, J.P., chairman of the North-West Midlands J.E.A., and seconded by Mrs. Boulton.

Lecturing recently to the Torquay branch of the Association, Miss Gilmer McVicker dealt with methods of refrigeration used throughout the ages. She showed that the old type of ice-box was unsuitable as its general temperature was well above 55 deg. F. (5 deg. above the maximum safe temperature). Electrical refrigeration not only provided a means for obtaining a cool dry temperature in which bacteria could not thrive, but it was also far more economical than an ice chest.

The Eastbourne Corporation Electricity Committee has arranged for Miss Haslett, director of the Electrical Association for Women, to visit Eastbourne with a view to forming a branch of the Association at a meeting to be held in the town hall on April 27th.

Standard Voltage Specification

British Standard Specification No. 77, "Voltages for New Systems and Installations," has been revised. As regards low voltages, no alteration to the existing standards has been made, but the number of standard high voltages has been somewhat reduced, and special provision has been made for the requirements of the high-voltage inter-connected networks of the Central Electricity Board. A special recommendation is made with regard to the voltage to be adopted for rural electrification schemes. Copies of the specification may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, S.W.1, 1s. 2d. post free.

Sequel to a Fire

In the King's Bench Division on Monday last before Mr. Justice Finlay a settlement was announced of the action brought by Mr. Albert E. Ryde, of Ipswich, against the Ipswich Corporation. Mr. Martin Hilbery, K.C., for the plaintiff, said the case arose out of an extensive fire which occurred in Ipswich through the breakdown of the electric cables. He thought it was exactly on all fours with a case decided in 1905 and in the circumstances the parties were now able to adjust the figures. Mr. Monckton, K.C., for the Corporation, associated himself with Mr. Hilbery's remarks.

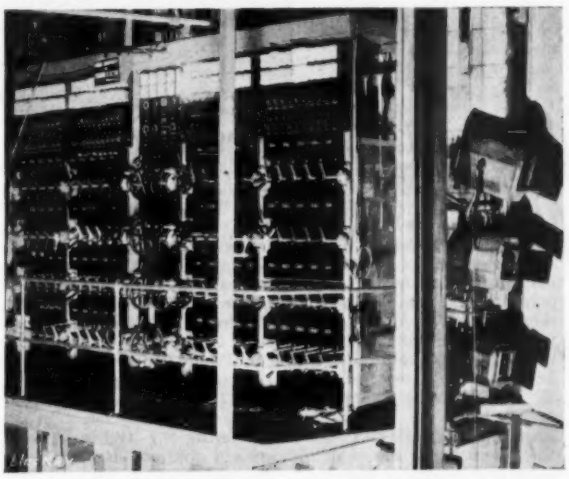
His Lordship gave judgment for the plaintiff for £7,333 10s., the amount agreed upon between the parties, and congratulated them upon arriving at a settlement. Mr. Hilbery added that counsel had endorsed upon their briefs a further agreement between the parties with regard to certain other claims, which were awaiting the result of this action.

Mercury-vapour Plant

The mercury boiler at South Menchow generating station of the Hartford Electric Light Co. (U.S.A.) has been put into operation again after having been equipped with new tubes throughout. On one day, the *Electrical World* states, the output was 696,000 kWh, with an efficiency of 9,560 B.th.u. per kWh (35.6 per cent.). The overall rate of the plant was 12,380 B.th.u. per kWh (27.5 per cent.). The present loading is 7,500 kW, or 75 per cent. of full rating. The unit had been out of commission for about 13 months while the tubes were redesigned, as the small button-like projections on the tube coil which centred it in the tube developed a rubbing action which led to leakage and constricted the vapour passage by the formation of a fine iron powder. All other parts were found satisfactory, and there was negligible loss through leakage. The boiler is now fired with oil. During the year previous to the shut-down the unit produced 135 million kWh, including energy generated from steam in the condenser, at a net overall rate of 10,200 B.th.u. per kWh.

Generation of Electricity in March

The official returns rendered to the Electricity Commissioners show that 1,090 million kWh of electricity was



The new switchboard installed at the Lyceum Theatre by the Strand Electric and Engineering Co. (*"Modern Theatre Lighting,"* p. 557)

generated by authorised undertakers in Great Britain during the month of March, 1932, as compared with the revised figure of 1,038 million kWh in the corresponding month of 1931 or an increase of 5 per cent.

During the first three months of 1932 up to the end of March the total amount of electricity generated by authorised undertakers was 3,385 million kWh, as compared with the revised figure of 3,193 million kWh for the corresponding period of 1931, representing an increase of 6 per cent.

High-voltage X-rays

The Massachusetts Institute of Technology announces a new X-ray tube to be operated at a potential of 15 million volts. Almost at the same time the University of Chicago reports contemplated investigations into the structure of matter with a 10,000,000-V tube. At the Johns Hopkins University there is in use for medical work a tube rated at 900,000 V, while at the U.S. Bureau of Standards a 2,000,000-V tube has been used in atomic investigations.

Appointments Vacant

Store- and time-keeper for Dover Electricity Department.

Showroom assistant for Dartford Urban District Council.

(See our advertisement pages to-day.)

Electricity Regulations in Ireland

The Minister for Industry and Commerce in February last made regulations in respect of the generation, transformation, distribution, and use of electrical energy in factories and workshops in the Irish Free State. These regulations, which were made in accordance with the provisions of the Factory and Workshop Act, of 1901, operate as from April 1st.

A Wimshurst Centenary

Last Wednesday was the hundredth anniversary of the birth of James Wimshurst, who is best known for the improvements which he made from 1882 onwards in the influence machine, many examples of which are still in use in hospitals. Wimshurst was the son of Henry Wimshurst, the shipbuilder, who introduced the screw propeller. His primary occupation for most of his life was that of shipwright surveyor, and he held important offices under the Board of Trade. His electrical, chemical, and other activities were pursued in a private workshop at Clapham, and were known only to a few close friends. Wimshurst was a Fellow of the Royal Society, a member of the Physical Society and the Röntgen Society, and a manager of the Royal Institution. He died on January 3rd, 1903.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. J. Howard Gill, who has been with the Fuller Electrical and Manufacturing Co., Ltd. (associated with Asea Electric, Ltd.), for a number of years, has been appointed manager of the Transformer and Regulator Department at the company's Walthamstow works. Mr. Gill was educated at King's College School, Wimbledon, and had had a considerable amount of electrical experience both at home and abroad before joining Fuller's. He was at one time with the London and North Western Railway Co., when he was engaged on the electrification of the suburban line between Euston and Watford. He left the railway company to take up a position with the British Electric Transformer Co., Ltd., and while with that company visited India and Spain. He subsequently joined Messrs. Rendell, Palmer and Tritton, consulting engineers, in their Hydro-Electric Branch, where his activities included work on the Perak hydro-electric scheme.

Mr. J. Howard Gill

Mr. F. J. Rymill, who for some years has been the works superintendent of Messrs. Pritchett and Gold and E.P.S. Co., Ltd., retired on April 1st, after 40 years' service with the company. Mr. Rymill joined the original company, which was then known as Messrs. Pritchett Bros., in 1892, when their works were situated in Soho Square, and went to their various works as they were moved, first to Woolwich in 1893, then to Feltham, Middlesex, in 1897, and finally to Dagenham Dock in 1914. During the whole of this period he has been associated with the manufacture of storage batteries. On his retirement Mr. Rymill was presented by Sir Archibald Gold, the chairman of the company, with a gold watch and cheque from the directors and staff, an illuminated address and barometer from the foremen in the works, and a bookcase-bureau from the employés.

As a result of the entrance scholarship examination held at Faraday House Electrical Engineering College on April 5th, 6th and 7th, the following awards have been made by the Governors of the College:—**Mr. A. H. Yates** (Faraday Scholarship), **Mr. A. E. Richards** (Maxwell Scholarship), and **Messrs. A. P. Wilson-Hafferden, C. W. Lex, F. B. Greatrex, and E. R. Longden Lewis** (exhibitions).

Mr. C. H. Cox, the new chairman of the Council of the British Electrical Development Association, to whose speech delivered at the annual luncheon of the North-Western Area reference is made in our leader pages, is a director of several electrical companies, namely, the Edison Swan Electric Co., Ltd., Edison Swan Cables, Ltd., and the Altrincham Electric Supply Co. He was chairman of the Electric Lamp Manufacturers' Association several years ago, and is a member of the Council of the Electrical Trades Benevolent Institution.

Mr. C. H. Cox, chairman of the E.D.A. Council

Dr. Ing. E. H. Feyerabend, the Secretary of State for the German Posts and Telegraphs, has been awarded the Siemens-Stephan Memorial Plaque by the German Elektrotechnischen Verein. The award is made only once every five years to persons who have assisted in the development of the Association in particular and the electrical industry in general.

Mr. Albert James Squire, the deputy commercial manager of the Stepney Electricity Department, is retiring after 32 years with the undertaking. Last week Mr. Tapper, on behalf of the staff, presented Mr. Squire with a case of golf clubs, and in doing so spoke of his hard work and long service.

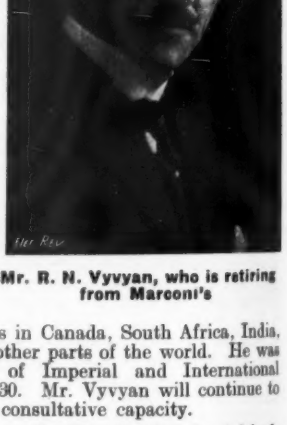
Mr. W. Baines has been appointed rolling stock superintendent by the Burnley Corporation Tram and Bus Committee in succession to Mr. F. L. S. Whitaker, who has retired.

Mr. R. A. Bibby, of Bolton, has been appointed chief sales and showroom assistant by the Worthing Corporation Electricity Committee at a salary of £250 per annum.

Mr. James Hill, of Messrs. Sharples, Hill & Co., Manchester, has taken his son, **Mr. James C. Hill** (who has been associated with the business for the last 18 years) into partnership, and the business will be continued under the title of James Hill and Son.

Major-General Sir Philip Nash has resigned from the board of Associated Electrical Industries, Ltd.

Mr. R. N. Vyvyan has retired from Marconi's Wireless Telegraph Co., Ltd., after 32 years' service. He was responsible for the erection of the world's first high-power wireless station at Poldhu in 1920, and he also erected a similar transmitter in the United States, the two stations effecting wireless telegraphic communication between America and Europe for the first time. He was an advocate of Imperial wireless communication, and was directing the construction of the first chain of stations when the war broke out and the P.O. cancelled the contract. He was engaged during the early part of the war in the construction of secret-service stations and later was responsible for 14 radio stations at strategic points in the Empire. He was appointed engineer-in-chief of the Marconi Co. in 1919. With the introduction of beam wireless, Mr. Vyvyan undertook the engineering design, construction and organisation of beam stations for the Post Office in England, and of corresponding stations in Canada, South Africa, India, and Australia, as well as in other parts of the world. He was appointed engineer-in-chief of Imperial and International Communications, Ltd., in 1930. Mr. Vyvyan will continue to serve the Marconi Co. in a consultative capacity.



Mr. R. N. Vyvyan, who is retiring from Marconi's

The marriage took place at the Parish Church, Ashford, Kent, on April 6th of **Mr. Owen Norman Soper,** divisional electrical engineer, B.B.C.I. Railway, India, and Miss Lydia Howland, of Ashford.

Alderman R. Corlett, who has been chairman of the Douglas (I. of M.) Corporation Electricity Committee since the inception of the electricity undertaking, has had the honorary freedom of the borough conferred upon him.

At the annual meeting of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers, the following officers were elected for the session 1932-33:—Chairman, **Mr. A. C. Livesey;** vice-chairmen, **Mr. B. Welbourn** and **Mr. R. G. Devey.**

Mr. A. S. Knapp, of the Sydney Municipal Electricity Department, has returned to Sydney after an absence of three years abroad investigating the latest developments in switchgear and cable production.

Lt.-Col. H. W. Woodall, C.I.E., has been appointed chairman and managing director of Parkinson & Cowan, Ltd., in succession to the late Sir Henry Cowan.

Mr. James D. Barron, chief assistant engineer to the Boston and District Electric Supply Co., was married on March 31st to Miss D. C. Emery, of Boston.

At the recent annual meeting of the Paisley Association of Electrical Engineers the following officers were elected for the session 1932-33:—President, **Mr. J. S. Kilpatrick;** vice-president, **Mr. A. Todd;** hon. secretary, **Mr. J. M. Barbour;** hon. treasurer, **Mr. G. H. Fisher.**

Obituary

Mr. St. George Lane Fox Pitt.—The death occurred last week at the age of 75 years of one whose name was very prominently before readers of the ELECTRICAL REVIEW in the earliest days of electric lighting, but is probably more or less unfamiliar to what we may describe as the younger members of the electrical industry. We refer to Mr. St. George Lane Fox Pitt, who invented the Lane Fox system of electric lighting and distribution and took out a number of patents. His first patent in connection with incandescent lighting was dated 1878 and it described a lamp with a platinum-iridium "wick," and a complete system of distributing the current by the aid of electric mains and branch wires with current meters and regulators. A full account of this appears in J. Dredge's "Electrical Illumination." The inventor "added secondary batteries to the circuit of the current at suitable points to act as electric reservoirs and keep the electromotive force throughout the system as uniform as possible." Other forms of lamp followed and one improved pattern was shown at the first Crystal Palace Electrical Exhibition. The Lane Fox system was subsequently worked by the Anglo-American Brush Electric Light Corporation, and the Alhambra Courts at the Crystal Palace were lit by chandeliers carrying Lane Fox lamps fed from a Sellon-Volckman secondary battery charged by a Brush machine.

Mr. Lane Fox Pitt was born at Walton in 1856 and scientific research and invention early became an interest—he was only 22 years of age when he took out the patents already mentioned. *The Times* quotes the late Mr. Campbell Swinton as describing him at the Royal Institution in 1912 as "the first person to imagine, or at any rate to patent, a public electricity supply to all and sundry." Mr. Cloudesley Brereton, writing to *The Times* last week, stressed his rare philosophic equanimity in the face of great financial and physical misfortunes, and added:—"Many experts believe that his invention of the carbon filament lamp was the decisive factor in the development of the commercial side of electric lighting and such, I understand, was the opinion of Edison himself. When through a lawsuit (fully reported in the ELECTRICAL REVIEW at the time.—EDS.) he later lost the patent rights accruing from that invention, the loss of the potential millions therein involved might well have soured the whole life of any ordinary man, but left him completely unaffected." Mr. Lane Fox Pitt passed away suddenly at his residence in South Eaton Place. The funeral took place on Saturday at Golders Green.

Mr. J. H. Ward.—We regret to learn of the death, which occurred at Manchester on April 8th, of Mr. James Henry Ward, a director of Messrs. Ward & Goldstone, Ltd. He was one of the founders of this well-known business when it began as a firm under modest auspices some forty years ago. He was sixty-five years of age. Mr. Ward possessed great ingenuity which he displayed in many ways, but particularly in the planning and designing of electrical wire-covering plant and machinery. Prior to his association with Mr. M. H. Goldstone in 1892, he was engaged on development work with the late Mr. Apps, with particular reference to large spark coils, arc lamps and other electrical appliances which were evolving from the experimental stage at that time. He was also connected with the General Electric Co., Ltd., for a number of years. Mr. Ward was a man of retiring though genial disposition, and his loss will be keenly felt by his colleagues on the board of Ward & Goldstone, Ltd.

Mr. F. R. Green.—The death is announced at the age of 31 years of Mr. Frank Reginald Green, manager of the Mortimer branch of the Wessex Electricity Co. He commenced with the Goring undertaking which was subsequently taken over by the Wessex Co.

Mr. T. Pollard.—The death occurred last week of Mr. T. Pollard, chief depôt inspector of the Leeds Corporation Tramways Department. He had been in the service of the Department for 35 years.

Wills.—Sir John Arthur Corcoran, director of the National Union of Manufacturers, left £7,405 (net personalty £6,727).

Mr. S. Gallagher, of Low Leaves, Hexham-on-Tyne, and of Exchange Buildings, Quayside, Newcastle-on-Tyne, chairman of the Hexham and District Electric Supply Co., Ltd., left £10,994 (net personalty £799).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

G. L. Ward & Co., Ltd.—Private company. Registered April 5th. Capital £1,000 in 10,000 ordinary shares of 1s. each and 500 5 per cent. non-cumulative preference shares of £1 each. Objects: to acquire the business of electrical and mechanical engineers carried on by G. L. Ward and E. Nicholas at Cardiff and elsewhere. The directors are: G. L. Ward, Mount Pleasant, Redbrink Crescent, Barry Island, Glam; and E. Nicholas, 24, Canada Road, Cardiff. Registered office: 9, Park Place, Cardiff.

Pix Valves, Ltd.—Private company. Registered April 5th. Capital £100 in £1 shares (50 "A" ordinary and 50 "B" ordinary). Objects: To manufacture or assemble wireless valves, electric lamps, and wireless and electrical parts, accessories, equipment and appliances, &c. The directors are: W. E. Debrunner, 70, Christchurch Road, Tulse Hill, S.W.; and C. S. Garland, "Oaklands," Battenhall, Worcester. Registered office: 42/43, St. Paul's Churchyard, E.C.

Charles R. Dibben, Ltd.—Private company. Registered April 4th. Capital £1,000 in £1 shares. Objects: To acquire the business of electricians and dealers in electric lighting appliances, &c., carried on by W. F. Maybury and A. H. Pepler at 22, Moteomb Street, S.W.1, as "Charles Dibben & Co." The permanent directors are: W. F. Maybury, 63, Brookville Road, Fulham, S.W.; and A. H. Pepler, 18, Parthenia Road, Fulham, S.W.6. Registered office: 22, Motcomb Street, S.W.1.

Cranmer & Cheshire, Ltd.—Private company. Registered April 6th. Capital £10,000 in £1 shares (3,750 6 per cent. cumulative preference and 6,250 ordinary). Objects: To acquire the business of manufacturers of electric lighting fittings, &c., carried on by Rosa C. Cheshire, D. B. Cheshire, and E. B. Cheshire at Steward Street, Spring Hill, Birmingham, as "Cranmer & Cheshire," together with certain of the assets. The first directors are: D. B. Cheshire, 57, Selwyn Road, Edgbaston, Birmingham; and C. F. Cheshire, 24, Melville Road, Edgbaston, Birmingham. Solicitors: Cottrell & Son, 10, Easy Row, Birmingham.

N.R.S., Ltd.—Private company. Registered April 6th. Capital £10,000 in 3,500 7½ per cent. cumulative preference shares of £1 and 30,000 ordinary shares of 1s. each. Objects: To carry on the business of manufacturers and importers and exporters of and dealers in radio, television, telephone and telegraph instruments, gramophones, &c. The joint managing directors are: W. A. Hunt, 11, Alexander Place, S.W.7; H. S. Prince, 229, Green Lanes, Clissold Park, N.4; and A. W. Hambling, 80, Brondesbury Road, N.W.6. Solicitors: Blundell, Baker & Co., 16, Serjeants Inn, E.C.4.

Ernest Turner Electrical Instruments, Ltd.—Private company. Registered April 9th. Capital, £30,000 in £1 shares. Objects: To acquire the business of a manufacturer of electrical measuring instruments now carried on by J. E. Turner at Chiltern Works, Totteridge Avenue, High Wycombe, Bucks, as "Ernest Turner." The directors are: J. E. Turner and N. Turner, The Chilterns, Princes Risborough, Bucks. Registered office: Chiltern Works, Totteridge Avenue, High Wycombe, Bucks.

Welsh Radio and Electrical Supplies, Ltd.—Private company. Registered April 7th. Capital £500 in £1 shares. Objects: to carry on the business of manufacturers of and dealers in wireless apparatus, electrical fittings, appliances, &c. The subscribers are: L. Goldstone, 139, Western Street, Swansea; and W. G. Cooper, Willows, Landore, Swansea. Solicitors: J. Ivor Evans & Benjamin, 4, College Street, Swansea.

Faraday House Wireless Co., Ltd.—Private company. Registered April 5th. Capital £5,250 in 5,000 8 per cent. cumulative participating preference shares of £1 and 5,000 deferred shares of 1s. each. Objects: To acquire the business of wireless manufacturers and dealers carried on by the Gilford Radio Electric Manufacturing Co. at Faraday House, 48, Blandford Street, Baker Street, W., and to adopt an agreement with A. Mitchell and G. L. H. Gilbert. The directors are: A. Mitchell, 12, Blandford Street, Baker Street, W.1; J. S. P. Colquhoun, Longridge, Claygate, Surrey; and G. L. H. Gilbert, 24, Portsdown Road, W.9. Secretary: D. P. Lund. Registered office: 430, Strand, W.C.2.

International Television Corporation, Ltd.—Private company. Registered April 9th. Nominal capital of £100 in 5s. shares. Objects: To acquire any interest in any inventions relating to television and any system for the transmission of pictures by wireless telegraphy or by wires, &c. The subscribers are: Sir Henry White-Smith, Kt., 55, Pall Mall, S.W.1, and G. W. Chisholm, 3, South Square, N.W.11. Registered office: Quadrant House, 55-6, Pall Mall, S.W.1.

A. W. Hambling, Ltd.—Private company. Registered April 6th. Capital £100 in £1 shares. Objects: To carry on the business of manufacturers and importers and exporters of and dealers in radio or wireless television, telephone and telegraph instruments, &c. The subscribers are: A. W. Hambling, 80, Brondesbury Road, N.W.6; and W. A. Hunt, 11, Alexander Place, S.W.7. Solicitors: Blundell, Baker & Co., 16, Serjeants Inn, E.C.4.

Returns of Electrical Companies

Highfield Electrical Co., Ltd.—Capital £15,000 in 500 6 per cent. cumulative preference and 14,500 ordinary shares of £1. Return dated January 1st, 1932. 13,350 ordinary shares taken up. £8,350 paid. £5,000 considered as paid. Mortgages and charges: £6,500 debenture covering fluctuating overdraft.

Flather & Co., Ltd.—Capital £20,000 in £1 shares. Return dated December 9th, 1931. 13,208 shares taken up. £11,708 paid. £1,500 considered as paid. Mortgages and charges: Nil.

Plessey Co., Ltd.—Satisfaction in full on February 22nd, 1932, of mortgage dated May 4th, 1925, and registered May 7th, 1925. (According to the register of mortgages the mortgage registered May 7th, 1925, originally secured all moneys due to bank not exceeding £7,000.)

Carrington & Button, Ltd.—Capital £6,000 in £1 shares. Return dated December 15th, 1931. 4,887 shares taken up. £1,803 paid. £3,084 considered as paid. Mortgages and charges: £500.

Brook Radio Co., Ltd.—Debenture dated March 10th to secure the total of moneys advanced and value of goods (taken at a value agreed and recorded in the books of the company), transferred to the company from time to time by R. G. Mitchell, 66, Wykeham Road, Hendon. Property charged on the company's undertaking and property, present and future, including uncalled capital.

West of England Electric Investments, Ltd.—Debenture dated March 30th to secure £350,000, charged on the company's undertaking and property, present and future, including uncalled capital. The holders are: Midland Bank Executor and Trustee Co., Ltd., and Viscount Cowdray.

A. Bodkin & Co., Ltd.—Mortgage dated March 25th, to secure £240, charged on 16, Cornfield Road, Eastbourne. Holders: Parkinson, Polson & Co., Ltd., 16, Cornfield Road, Eastbourne.

Modern Radio, Ltd.—H. Lomax, 83, Bridge Street, Manchester, was appointed receiver on March 22nd under powers contained in debenture dated June 18th, 1931.

Baxter & Caunter, Ltd.—A. A. Lough, 6, Fredericks Place, Old Jewry, E.C., was appointed receiver on March 31st under powers contained in debenture dated March 6th, 1929.

Electric Supply Co. of Victoria, Ltd.—Satisfaction in full on July 1st, 1931, of charge dated December 19th, 1930, and registered March 11th, 1931. (Notice filed April 2nd, 1932.) (According to the register of mortgages, the charge registered March 11th, 1931, originally secured £15,635, and any further sums to be lent.)

Bodmin Electric Light & Supply Co., Ltd.—Satisfaction to the extent of £2,000 on March 1st of debentures authorised January 19th, 1922, and registered February 21st, 1922.

F. J. Jones & Co., Ltd.—Capital £5,000 in £1 shares. Return dated December 12th, 1931. 3,700 shares taken up. £2,050 paid. £1,650 considered as paid. Mortgages and charges: Nil.

Century Electric Co., Ltd.—Capital, £5,000 in £1 shares. Return dated September 16th, 1931 (filed January 1st, 1931). 2,387 shares taken up. £2,387 paid. Mortgages and charges, nil.

Bray, Markham & Reiss, Ltd.—Capital, £20,000 in 10,000 6 per cent. preference and 10,000 ordinary shares of £1 each. Return dated December 29th, 1931. 10,000 preference and 7,080 ordinary shares taken up. £16,080 paid on the preference and 6,080 ordinary shares. £1,000 considered as paid on 1,000 ordinary shares. Mortgages and charges, nil.

W. C. Pearson & Sons, Ltd.—Capital, £6,000 in £1 shares. Return dated January 27th, 1932. All shares taken up. £6,000 considered as paid. Mortgages and charges, nil.

Electrolumination (Abadie Process), Ltd.—Capital, £5,000 in 3,000 7½ per cent. cumulative ordinary shares of £1 and 40,000 deferred shares of 1s. each. Return dated February 23rd, 1932. 3,000 ordinary and 40,000 deferred shares taken up. £2,950 paid on the ordinary shares, leaving £50 calls unpaid. £2,000 considered as paid on the deferred shares. Mortgages and charges, £1,700.

Daventry & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 29th, 1931. All shares taken up. £750 paid. £250 considered as paid. Mortgages and charges, nil.

Climax Electric Co., Ltd.—Capital, £10,000 in 5,000 preference and 5,000 ordinary shares of £1 each. Return dated December 31st, 1931. 1,078 preference and 3,039 ordinary shares taken up. £1,617 paid on 1,078 preference and 539 ordinary shares. £2,500 considered as paid on 2,500 ordinary shares. Mortgages and charges, nil.

A. E. Acton Burnell, Ltd.—Charge on 27, Church Street, Soho, W.1, dated April 1st, to secure £2,100. Holder: Mrs. S. Arnold, 14, Marlborough Road, St. John's Wood, N.W.8.

Ashton Electrical Co. (Preston), Ltd.—Memorandum of Deposit dated April 4th, charged on 8, Tulketh Brow, Ashton-on-Ribble, within Preston, to secure all moneys due or to become due from the company to Manchester & County Bank, Ltd.

City Notes

The Anglo-Portuguese Telephone Co., Ltd., held its annual meeting on April 6th, Sir Alexander Roger (chairman) presiding. In presenting the report and accounts (ELEC. REV., April 1st, p. 509), the chairman said that the commission appointed by the Portuguese Government to examine the company's affairs, following a petition by the company, had not yet completed its investigations, but a decision was expected shortly. Referring to progress made in Portugal, the chairman said that it was one of the first countries to adopt the telephone on a commercial basis. In 1887 they acquired the business of the Edison Gower Bell Telephone Co. of Europe, Ltd., and had provided telephone service since then in the districts of Lisbon and Oporto. On December 31st last the company's stations numbered 31,000; there had been an average increase of 620 new stations a year during the past fifty years. To meet the exacting demands of a modern telephone service, continuous and expensive research was necessary. The company had at its command the whole technical as well as the financial resources of one of the largest groups of companies in the fields of research, manufacturing and world-wide telephone operation. The growth of the company's business during 1931 showed a 7 per cent. net increase, represented by 2,026 additional stations. Towards the close of the year an intensive telephone canvassing drive was launched in which the whole of the company's employés were engaged in their spare hours. In five weeks, 1,827 stations were added, of which 1,262 were new subscribers. They were continuing to maintain a satisfactory position, and could look forward to very considerable further development.

Ericsson Telephones, Ltd.—Presiding at the annual meeting on Tuesday last, Sir Harold A. Wernher (who recently succeeded Mr. W. M. Crowe as chairman) said that the report for the past year could be considered satisfactory in view of the acute trade depression. During the year the company had completed a number of important automatic exchanges, including Gladstone and Hampstead in the London area, and all-electric totalisator installations had been supplied to the Racecourse Betting Control Board for several racecourses. The company was also directing its attention to other installations which were likely to prove profitable in the near future. Satisfactory progress had been made in the manufacture for use and for sale of cellulose varnishes and lacquers. After referring to the progress made in the Post Office telephone system, the chairman mentioned the death of Mr. Ivar Kreuger. He said that since the incorporation of the company the L. M. Ericsson Telephone Co. had owned the majority of its ordinary shares. About two years ago Kreuger & Toll acquired a controlling interest in the L. M. Ericsson Co., and that was the full extent of the company's relationship with Kreuger & Toll. Sir Harold Wernher then reviewed the accounts for 1931 (ELEC. REV., April 1st, p. 509), and concluded with a tribute to the work of the company's staff.

The Brompton & Kensington Electricity Supply Co., Ltd., held its annual meeting on April 7th, Mr. H. R. Beeton (chairman) presiding. In presenting the report and accounts (ELEC. REV., April 1st, p. 509), the chairman said that the past year was the last under the original Provisional Order, and the current year was the first under the conditions of their extended tenure. By the adjustment of their frequency to that of the consolidated system of the London Power Co. in the latter half of 1928 they were able not only to obtain the benefit of "pooled costs," but to quadruple their potential capacity of supply on the site of their old generating station. They had carried out a corresponding enlargement of the distributing system at a cost of upwards of £40,000, and were thus able to meet all requirements for many years to come. They were encouraging the use of electricity for domestic purposes, and had opened new and enlarged showrooms. The sales of electricity showed an increase of 13 per cent., as compared with the preceding year, they had earned 4 per cent. more revenue in spite of a reduction in the average price charged, and the number of consumers had increased from 11,565 to 11,931, mainly owing to the conversion of large houses into flats. The two-part tariff was being increasingly adopted, and this form of supply now represented some 25 per cent. of the total output.

The South Wales Electrical Power Distribution Co. reports net receipts for the year ended December 31st last of £113,912, as compared with £117,062 in the preceding year. After deducting debenture interest, &c., and adding £3,210 brought in, there is a total of £25,760 available. It is proposed to transfer £20,000 to depreciation and reserve and to carry forward £5,760. The capital expenditure during the year amounted to £69,743. An additional eighteen miles of overhead and underground mains and cables were brought into service, making the total length over 398 miles. Supplies were made available in a number of new districts, and a Special Order was obtained covering the urban district of Nantyglo and Blaina. The number of consumers showed an increase of about 27 per cent., as compared with the preceding year. Application has been made in the present session of Parliament for a Bill conferring further powers on the company. Mr. P. M. Rossdale has retired from the board and Mr. G. P. Tutcher has retired from the joint secretaryship; Mr. C. P. Dawes has been appointed secretary. Meeting: April 26th.

The Notting Hill Electric Lighting Co., Ltd., reports a profit, including £32,590 brought in, of £99,837 for the year ended December 31st last, as compared with £99,790 in the preceding year. After deducting debenture interest, &c., it is proposed to pay a final dividend on the deferred shares of 4s. 1.365d., making 9s. 1.365d. for the year (against 17s. 4.408d.), leaving £24,137 to be carried forward. It is proposed to transfer £11,986 to special reserve, making £133,897, and the consent of members is asked to the capitalisation of these reserves in the form of ordinary shares. The purchase of electricity in bulk amounted to 13,815,606 kWh, and the sales totalled 10,985,936 kWh, against 10,235,134 kWh. The number of consumers increased from 11,936 to 12,500, and the connected load from 21,283 to 22,100 kW. Meeting: May 3rd.

The Chelsea Electricity Supply Co., Ltd.—The annual meeting was held on April 7th, when Mr. W. R. Davies (chairman) said that the principal item of capital expenditure during the year was £30,465 for mains, and they had spent £123,265 on this account since June, 1925. The receipts from the sale of electricity showed practically no increase, although the energy sold was 885,000 kWh more. This was due to the increased use of the two-part tariff. The rates had risen from £12,012 to £18,449; they were appealing against this. Their area of supply was suffering from the prevailing depression. More houses were empty, and there were many acres cleared for rebuilding which was held up. Given any reasonable movement towards prosperity, their business should make considerable strides.

The Edison Swan Electric Co., Ltd., reports that after making provision for debenture interest, depreciation, &c., there is a net profit of £29,764 for 1931, as compared with £53,436 in the preceding year. It is proposed to pay a dividend of 6 per cent., less tax, on the ordinary shares (against 10 per cent.) and to carry forward £10,778. During the year Mr. P. Kelly was appointed managing director, and Mr. J. N. Stephens has been appointed a technical director. Meeting: April 19th.

The International Telephone and Telegraph Corporation has announced that the contract with the Kreuger & Toll Corporation to purchase control of the L. M. Ericsson Telephone Company was voided by mutual consent during the late M. Kreuger's last visit to America.—*Reuter* (New York).

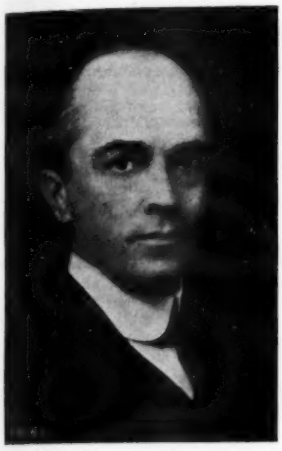
Babcock & Wilcox, Ltd., have declared a final dividend of 7 per cent. on the ordinary shares, making 14 per cent., less tax, for the year, against 14 per cent. tax-free, for 1930.

The Hydro-Electric Securities Corporation reports a net income of $2,817,635 for 1931, as compared with $4,133,694 in the preceding year. The class "B" cumulative participating preferred stock dividend absorbed $1,000,000, and dividends totalling $1 (against $2) per share were paid on the common stock. The surplus for the year was $341,242. The surplus account at December 31st was $9,342,472, of which $8,197,297 was placed to

investment reserve, being capital or realisation of profits made on the sale of investments during the years 1927 to 1930. The total earned surplus at December 31st last was therefore £1,486,417.

The Great Northern Telegraph Co., Ltd., of Denmark, reports that in order to make possible a total dividend and bonus of 20 per cent. (including the 5 per cent. already paid) for the year 1931, the directors propose to transfer £208,333 from interest on reserves to the revenue account, whilst no contribution from net profits to reserves is proposed. The pension fund receives £33,333. It is further proposed to carry forward £291,907 to the accounts for 1932 and to carry over from the balance sheet the sum of £256,921, being profit from the sale of shares in other undertakings.

The British Thomson-Houston Co., Ltd.—The annual meeting was held on April 13th, Mr. W. C. Lusk (chairman) presiding. In presenting the report and accounts (Elec. Rev., April 8th, p. 545), the chairman said that the orders received and the shipments from their factories during the past year were both less than in the previous year, and the unexecuted orders on hand at the close of the year were less than at the end of 1930. The number of employés at the end of the year was 12 per cent. less than at the end of the preceding year. They had continued to pursue the policy of co-operation with the other companies of the A.E.I. group, particularly in the fields of research and engineering. The economic depression had affected their business, particularly with respect to the heavier engineering products. Due, however, to the considerable time which elapsed between the date on which contracts for the heavier engineering products were taken and the date on which such contracts were completed and billed, the full effect of the falling-off in business in such lines was not felt at once. For this reason 1932 would be a more difficult year than 1931, unless there was a marked improvement in business generally within the next few months. The abandonment of the gold standard placed British electrical manufacturers in a more favourable position to compete for overseas business, but the volume of this business was small and the prospects of an increase in the near future were not good. In the belief that the anti-dumping duties would be retained and that in the case of mass production articles, such as electric lamps, an increased demand for British-made articles would result, with consequent lower manufacturing costs, the price of "Mazda" lamps had been reduced, and a similar course was followed by other important British lamp manufacturers. Contracts completed during the year included a 10,000-kW turbo-alternator for the Detroit Edison Co. (U.S.A.), to operate at 1,000 deg. F., which was put into commission in Detroit. They were manufacturing for the Government of the Punjab, for the Uhl River hydro-electric scheme, transformers and switchgear for seven 132,000-V sub-stations, and for eight 66,000-V sub-stations, to which power would be supplied by four 12,000-kW water wheel driven alternators. For the Tummel generating station of the Grampian Electricity Supply Co. they were manufacturing two 20,000-kW water-wheel driven alternators. They had supplied the turbo-electric propelling machinery for the P. & O. vessels *Strathnaver* and *Strathaird*, for the *Ragantira* of the Union Steamship Co., and the Diesel-electric tanker *Permian* for the Atlantic Oil Shipping Co. The prices obtained by manufacturers as a result of the reduction in the volume of electrical business continued to be unreasonably low. In the case of practically every line manufactured by the company there existed in this country a large excess of manufacturing facilities over the maximum requirements of the home and overseas markets. In spite of this it seemed possible that further manufacturing facilities might be established in the mistaken belief that they would be necessary to take care of the additional business in British-made products which should result from the duties on imports. Such a development would not be good for the industry, and would provide no more work for labour than could be provided by the use of the existing manufacturing facilities. The steps commenced last year to effect economies were being continued.



Mr. W. C. Lusk, Chairman of the British Thomson-Houston Co., Ltd.

The Folkestone Electricity Supply Co., Ltd., reports a profit of £63,769 for 1931, to which is added £2,871 brought in. After deducting debenture interest, &c., and making various allocations to reserves, it is proposed to pay a final dividend on the ordinary shares and on employés' co-partnership shares of 6 per cent. (tax free), making 10 per cent. for the year (same), and to carry forward £3,567. The sales of electricity increased from 5,087,043 to 5,571,334 kWh.

The Tamworth District Electric Supply Co., Ltd., in its report for 1931 shows a net profit of £4,910, to which is added £464 brought in, making £5,374. A final dividend of 4 per cent. is paid on the ordinary shares, making 6 per cent. for the year, and £1,292 is carried forward. In order to meet the increasing power load in the central area, the construction of another h.p. transmission line has been rendered necessary.

Parker, Winder & Achurch, Ltd., report a loss of £3,642 for 1931, against a profit of £2,342 in the preceding year. The amount brought in is £9,255, making £5,613 available. The preference dividend is paid and £4,623 is carried forward. The ordinary dividend for 1930 was 6 per cent.

Aktiebolaget Elektrolux reports a net profit for the past year of Kr. 7,073,000, as compared with Kr. 8,043,000 for the previous year, and the directors propose a dividend of 8 per cent. against 9 per cent.—*Reuter's Trade Service* (Stockholm).

The River Plate Electricity Co., Ltd., reports a net revenue of £52,684 for 1931, against £55,004 for 1930. The ordinary dividend is maintained at 10½ per cent., reserve receives £7,500, and £8,290 is carried forward.

The Calcutta Electric Supply Corporation, Ltd., has announced a final dividend of 7 per cent., making 12½ per cent. for the year (same), plus a cash bonus of 3d. (against 5d.) per share, less tax at 2s. 6d.

The Madras Electric Tramways (1904), Ltd., reports a net profit for 1931 of £11,685, to which is added £6,521 brought in, making £18,206. It is proposed to pay a dividend of 5 per cent. on the ordinary shares and to carry forward £7,051.

The Eastern Telegraph Co., Ltd., announces the payment, on May 2nd, of interest for the half-year ending April 30th on the 4 per cent. mortgage debenture stock.

The Wellingborough Electric Supply Co., Ltd., reports a net profit for 1931 of £3,835. A dividend of 5 per cent. is proposed (same), leaving £1,843 to be carried forward.

Associated Electrical Industries, Ltd., has recommended a dividend of 4 per cent. on the ordinary shares for 1931 (against 6 per cent.), the carry-forward being £99,899 (£110,410).

The West London & Provincial Electric & General Trust has declared a final dividend on the ordinary shares of 2½ per cent., making 5 per cent. for the year (against 9 per cent. for 1930).

Stocks and Shares

Tuesday Evening.

THE near advent of the Budget which Mr. Neville Chamberlain will open on Tuesday in next week is a live influence in the Stock Exchange markets these days, expectation looking for a reduction in the income tax, but feeling a little less certain than it was a month ago as to the likelihood of a conversion scheme of the five per cent. War Loan being unfolded. The debacle on the Continent caused by the suicide of the late Mr. Ivar Kreuger, together with a financial crisis in the United States, has modified the situation as it seemed likely to develop not more than a month ago. The immediate effect was to bring about a general fall in the values of gilt-edged securities, in which those of the electricity authorities participated. The London and Home Counties recently issued five per cent. scrip, which fell to 5/16ths discount after allotment, rose to ¼ premium within a fortnight, and went back to par, now stands at ⅛ premium. Central Electricity five per cent. scrip keeps very firm at 6¾ premium. The five per cent. debenture stock of the Shropshire, Worcestershire and Staffordshire Electric Power Company, for which the company received 93, is quoted at 100, having been about a point higher.

The Gilt-Edged List

The Home Railway debenture stocks are not so much in favour as they were, Metropolitan District debenture going back from 6¼ premium to 5¾ premium. The Metropolitan Railway five per cent. debenture at 2½ premium is ¼ lower on the week. These movements reflect the uncertainty felt in regard to the Government's intention concerning the five per cent. War Loan, because if the latter is not paid off, or, alternatively, converted, the demand for gilt-edged stocks on the part of the public may possibly slacken. On the other hand, money remains very plentiful, and although Bank Rate up to last Thursday was retained at 3½ per cent., there is a strong probability of its being lowered to three per cent., and of remaining there. North Metropolitan Electric 5½ per cent. debenture, 1959, has risen to 101½, the same price, that is to say, as the company's 1966 issue. City of London Electric five per cent. debenture at 102 is two higher. A similar improvement lifted Lancashire Electric five per cent. debenture to 100. There is a pronounced scarcity of stock in this market.

Home Electricity Supply Shares

Now that the prices of the ordinary shares in the Home Electricity Supply group are quoted ex dividend, it will be noticed that the general range of values strikes an average of about 28s. for the companies that come under the London Electricity Supply Acts. Taking the standard dividend as likely to be seven per cent. for a time—and many people are inclined to look for something better than this—the yield at that rate would be five per cent. on the money, taking the shares at 28s. This shows that the London electricity supply shares are now regarded as gilt-edged investments of the industrial class, the prices more likely to be governed, it may be, by monetary considerations than by those of the actual volume of business that the individual companies handle.

Scottish and Provincial

The County of Durham Electric Power Distribution reports a net profit of £32,500, being about £75 better than that of the previous year. The ordinary shares are privately held. The Folkestone Electricity Company declares a final dividend on the ordinary and employés shares of six per cent. tax free, making 10 per cent. for the year. The ordinary shares were absorbed, it may be remembered, by the County of London Electric Supply Company. A few free shares remain; the price is about 45s. The five per cent. preference stand

at 20s. ex dividend, and the 4½ per cent. first debenture stock at 92½. Scottish Power ordinary shares have lost part of their rise of last week, going back to 28s. 9d. Clyde Valleys keep firm at the same price. Newcastle-on-Tyne ordinary are easier at 23s. 9d. The Electrical Distribution of Yorkshire, Ltd., recently offered new six per cent. preference shares at a guinea. The issue was over-subscribed about nine times. Dealings are expected to start towards the end of this week. Northampton new shares have hardened to 9s. 3d. premium.

Dollar Stocks

After undergoing a further spasm of acute weakness, the list of American utility stocks and shares made something of a recovery in the early part of the present week. The buying power of the New York Stock Exchange is obviously greatly weakened. A long string of causes, amongst them being the failure of hundreds of banks, culminated in the crash caused by the Kreuger tragedy, and the Wall Street Stock Exchange approached a condition of demoralisation. Some of the big people stepped in and took matters in hand when the fall threatened to develop into a semi-panic, but the values of to-day are mere shadows of their former selves in recent years. When such a sound stock as American Telephone and Telegraph can drop from 199 this year to the current price of 140, it is obvious that there is something seriously wrong in the state of the U.S.A. The fall in American Telephones is 5 points on the week. International Telephones have declined 1¼ to 7. Latin-Canadians are still very heavy, Shawinigans being 16, Power Corporation of Canada 16¼, Montreals 33½ xd. Brazilian shares have gone the same way, Brazilian Traction common falling to 12. Mexicans have developed no further severe flatness.

The Hydro-Electric Securities Corporation has issued its annual report, showing a total ordinary income of £640,000 at par as against £854,000 in the previous year. The extraordinary income came to $2,000, whereas last year it was well over $3,000,000, by far the greater part of the latter being profits from realisation of investments. The net income is £893,000 down on the year. The price of the shares, which had fallen to 6¾, rallied a point on the announcement of these results, which were not quite so calamitous as some people thought they might turn out to be. International Holdings, whose report came out at the same time, are now quoted at $1.

Home Railway Stocks

The fall of 1s. in Underground Electric ordinary reduced the price to 18s., at which, taking the last paid 7 per cent. dividend as a basis of calculation, the return comes to 7¾ per cent. Metropolitan and Metropolitan Districts are again lower, but the Central London assented stocks are all higher, at the common level of 72½. Stocks in the steam railway group have rallied fairly sharply upon the impression that extra duties are to be imposed in the near future upon imports that affect, more particularly, the iron and steel trade. These rumours brought about abrupt recoveries in such shares as Vickers, where the price rose from 6s. 3d. to 1s. higher.

Amongst the London Traction shares, London and Suburban 5 per cent. preference have fallen back to 5s. 9d. London United Tramways debenture is unchanged at 57½.

Manufacturing and Equipment

Associated Electrical Industries ordinary shares have shed 4s. 6d., going back to 17s. 6d. upon announcement of a dividend of 4 per cent. for the year 1931, comparing with 6 per cent. in 1930. The carry-forward of £99,899 is £10,000 less. The issued capital of the company comes to a little over £6,000,000 sterling, of which nearly £5,000,000 is in ordinary shares. On this announcement General Electric ordinary fell away to 37s. Siemens are weak at 21s. 3d.

Amongst the electrical equipment shares, falls are shown by Callenders, Enfields, and Henleys, though the last-named company's 4½ per cent. preference shares have improved to 4¼. Jobbers in the market offer no explanation for the dullness of cable and equipment shares other than that of a few shares coming in for sale on behalf of people apparently disappointed with the failure of trade as a whole to revive as quickly as they had expected it to do. The Edison Swan Electric, which is controlled by the Associated Electrical Industries, is reducing its dividend to 6 per cent., which goes against 10 per cent. in the previous year. The company's first preference shares quoted in our lists stand at 23s. 3d., and the 5 per cent. debenture stock ex the April interest is about 90. Of this stock, the issued amount is the bagatelle of £47,267. Babcock & Wilcox are 1/16 lower at 43s. 9d. The company has declared a dividend of 7 per cent., making 14 per cent. for the year, less tax. This goes against an equal amount in the previous year, paid, however, free of tax.

Cables and Wireless

Fresh falls have taken place in Cables and Wireless stocks, the three issues suffering from a weakness which has attacked the market as a whole. Falls occurred in Marconi Marines and International Automatics, the latter giving way to 31s. 3d. Anglo-American Telegraph deferred is better at 23½, the stock coming into demand owing to the cheapness of money.

Tokyo Electric sixes at 73 are a couple of points lower, and Atlas ordinary shares have receded to 11s. 3d. Calcutta Electric Supply shares are easier at 39s. 6d. The outstanding feature of the markets is the strength of investment securities as a whole.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1930.	1931.	Price. April 12.	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies						
Bournemouth and Poole	1	15	15	62/-	—	4 16 9
Brompton Ordinary	1	8½	8½	28/6	+1/-	4 18 1
Central Electricity 4½% Deb.	Stock	4½	4½	95½	—	4 14 1
Charing Cross Ordinary	1	8½	8½	31/-	—	4 10 4
Chelsea	1	8½	8½	26/-	—	5 7 8
City of London	1	10	10	27/6	-9d.	5 1 10
Clyde Valley	1	8	7	28/9xd.	—	4 17 5
County of London	1	11	10½	43/9xd.	—	4 16 6
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Dis. Yorkshire	1	9	9	35/-	—	5 2 10
Elec. Supply Corporation	1	11	—	47/6	—	4 12 7
Kensington Ordinary	1	8	8	28/-xd.	—	5 0 0
Lancs. Light and Power	1	6½	7	27/-	—	5 3 8
London & Home Counties 4½% Deb.	Stock	4½	4½	93	—	4 16 10
London Electric	1	9	9	27/6	—	5 1 10
Metropolitan	1	10	10	41/3	—	4 17 0
Midland Counties	1	7	7	28/9	—	4 17 5
Mid. Elec. Power	1	8	8	30/6	—	5 5 0
Newcastle-on-Tyne Ordinary	1	6	6	23/9	-9d.	5 1 1
Do. 7% Pref.	1	7	7	27/6	—	5 1 10
Northampton	1	10	10	40/9	+⅛	4 18 1
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	24/6	—	4 18 0
St. James' and Pall Mall	1	8	8	28/-	—	5 0 0
Scottish Power	1	8	—	28/9	-9d.	5 11 4
South London	1	8½	8½	28/-	—	5 0 0
Urban Ordinary	1	7	—	28/3	—	4 19 1
Westminster Ordinary	1	8½	8½	28/-	+6d.	5 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/-xd.	—	6 16 8
Yorkshire Elec.	1	8	8	33/9	—	4 14 10
Home Rails.						
Central London Ord. Assented	Stock	4	4	72½	+2	5 10 4
Metropolitan	„	4	3½	32½	-2	10 15 4
Do. District	„	5	4½	51½	-1	8 14 10
Underground Electric	1	8	7	18/-	-1/-	7 15 7
Telegraphs and Telephones.		1929.	1930.			
American Tel. & Tel.	$100	9	9	140	-5	6 8 7
Anglo-Am. Tel. Pref.	Stock	6	6	99½	—	6 0 7
Do. Def.	„	1½	1½	23½	+1	6 7 8
Cables & Wireless 5½% Pref.	„	5½	5½	47½	-2	—
Do. A 7½% Ord.	„	Nil	—	15	-3	—
Do. B Ord.	„	Nil	—	9	-1½	—
Globe Tel. and T. Ord.	10	10	8½	5½	—	—
Do. do. Pref.	10	6	6	7	—	8 11 6
Great Northern Tel.	10	20	20	23	—	8 13 10
Marconi-Marine	1	15	15	27/6	-⅛	7 5 6
Oriental Telephone Ord.	1	12	12	2½	—	*5 12 0
Home and Foreign Trams, etc.						
Anglo-Arg. Trams First Pref.	5	5½	—	6/3	—	—
Do. do. 2nd Pref.	5	6	—	3/9	—	—
Do. do. 5% Deb.	Stock	5	5	9	-2½	—
British Electric Traction Def. Ord.	„	5	5	750	-50	—
Do. do. Pref. Ord.	„	8	8	121½	—	6 11 9
Brazil Traction	100	8	—	12	-1½	8 6 8
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
London & Sub. Trac. 5% Pref.	1	Nil	Nil	5/9	-⅛	—
London United Tram Deb.	Stock	4	4	57½	—	6 19 2
Mexico Trams, 5% Bonds	—	5	5	37½	-4	13 6 8
Mexico Light Common	100	Nil	Nil	17½	-5	—
Do. 7% Pref.	100	7	7	37½	-2	17 14 6
Do. 1st Bonds	—	5	5	72½	-3	6 18 0
Victoria Falls Ord.	1	15	15	61/3	—	4 18 0
Yorkshire (West Riding)	1	Nil	Nil	5/3	—	—
Manufacturing Companies.						
Assoc. Elec. Ord.	1	6	6	17/6	-4/6	4 11 5
Do. Pref.	1	8	8	28/9	—	5 11 4
Babcock & Wilcox	1	15	14	43/9	-⅛	*6 6 0
British Aluminium Ord.	1	10	10	25/-	-⅛	4 0 0
British Insulated Ord.	1	15	15	60/-	—	5 0 0
Brush Ord.	Stock	10	5	60	—	8 6 8
Callender's	1	15	15	57/6	-9d.	5 4 2
Do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Parkinson Ord.	5/-	30	30	18/9	—	8 0 0
Do. 8% Pref.	1	8	8	27/6	—	5 16 5
Edison-Swan 1st Pref.	1	7½	7½	23/3	—	6 9 0
Do. 5% Deb.	Stock	5	5	89½	—	5 11 10
Electric Construction	1	5	Nil	7/6	—	—
Enfield Cable Ord.	1	25	25	3½	-⅛	7 2 10
English Electric	1	Nil	Nil	8/9	-⅛	—
Do. do. Pref.	1	Nil	Nil	10/-	-⅛	—
Ever Ready	5/-	35	35	24/6	—	7 2 10
Ferranti Pref.	1	7	7	22/-	+9d.	6 7 3
G.E.C. Pref.	1	6½	6½	26/-	—	5 0 0
Do. Ord.	1	14	10	37/-	-½	5 8 1
Henley's	1	30	30	5½	-½	5 17 1
Do. 4½ Pref.	5	4½	4½	4½	+½	5 6 0
India-Rubber	1	Nil	Nil	5/9	—	—
Johnson & Phillips	1	10	10	1	—	10 0 0
Siemens Ord.	1	7½	7½	21/3	-2/-	7 1 2
Telegraph Construction	12	10	7½	9½	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1930

33,288. "Wireless telephone systems." W. W. Triggs (Signal-Funk-Ges.). November 5th, 1930. (369,198.)
33,474. "Electric cooking apparatus." C. E. Jones and W. S. Burge. November 7th, 1930. (369,199.)
35,229. "Electrical motor generator sets." Electrical Research Products, Inc., R. A. Bull, and R. J. P. Jeffcock. December 1st, 1930. (369,201.)
35,499. "Process for determining the bearing of any source of radio-electric emissions." R. J. Hardy and Soc. des Etablissements H. Lepaute. December 4th, 1929. (369,202.)
37,175. "Electric remote metering systems." British Thomson-Houston Co. December 13th, 1929. (369,247.)
37,618. "Socket members of electrical plug and socket couplings." J. A. Crabtree and B. G. Harrison. December 13th, 1930. (369,210.)
37,785. "Grid electrode for electron-discharge tubes." Standard Telephones & Cables, Ltd., L. H. Bedford, D. G. Coveney, and E. O. Smith. December 15th, 1930. (369,217.)
37,936. "Electrical resistances, heaters, and the like." E. T. Williams. December 16th, 1930. (369,231.)
37,938. "Electric heaters." I. Lubbock, J. R. Joyce, and Asiatic Petroleum Co., Ltd. December 16th, 1930. (369,232.)
37,967. "Electric circuit interrupters." G. A. Juhlin and Associated Electrical Industries, Ltd. December 16th, 1930. (369,235.)
38,065. "Sound records and methods of producing the same." Radio Corporation of America. December 18th, 1929. (369,276.)
38,100. "Electric measuring instruments." British Thomson-Houston Co., Ltd. December 19th, 1929. (369,254.)
38,118. "Apparatus for the electrostatic removal of dust." H. G. C. Fairweather (Fumivorite et Depoussierage Industriel). December 17th, 1930 (Convention date not granted). (369,255.)
38,156. "Mercury-vapour lamps operating at above atmospheric pressure." F. R. K. von Turkenburg. December 20th, 1929. (369,277.)
38,167. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd., and J. H. E. Baker. December 18th, 1930. (369,278.)
38,182. "Cable sealing bells or other insulators for use on high-voltage circuits." A. Reyrolle & Co., Ltd., and A. Allan. December 18th, 1930. (369,279.)
38,220. "Electric vacuum switches." British Thomson-Houston Co., Ltd. December 18th, 1929. (369,281.)

1931

290. "Electrical circuits." Kolster-Brandes, Ltd. (Kolster Radio Corporation). January 3rd, 1931. (369,304.)
687. "Arrangement for protecting electric systems against excess voltages." Etablissements Merlin & Gerin. January 18th, 1930. (369,306.)
1,181. "Television." R. J. Pattinson. January 13th, 1931. (369,311.)
2,084. "Tumbler and like electric switches for mounting on the surface of a wall or the like." General Electric Co., Ltd., and F. E. Deeble. January 21st, 1931. (369,318.)
2,335. "Thermionic valve amplifier." Kolster-Brandes, Ltd., and W. S. Percival. January 23rd, 1931. (Cognate application, 10,029/31.)) (369,321.)
4,278. "Television, photo-telegraphic, or the like systems and apparatus." R. G. Wilson. February 11th, 1931. (369,335.)
4,881. "Plug contacts." Johnson & Phillips, Ltd., and P. M. Wood. February 16th, 1931. (369,342.)
5,088. "Electric fuses." C. W. Cox. February 18th, 1931. (369,346.)
5,233. "Manufacture of electric discharge vessels." M-O Valve Co., Ltd., C. G. Eden, and C. J. Smithells. February 19th, 1931. (369,348.)
5,885. "Electricity meters." W. Lawson. February 25th, 1931. (369,357.)
6,095. "Directional transmission or reception of wave energy in space." Electroacustic Ges. April 3rd, 1930. (369,360.)
6,573. "Brushes and brush holders for dynamo machines." A. de Riz and Allmänna Svenska Elektriska Aktiebolaget. March 3rd, 1931. (369,366.)
7,070. "Electric heating elements or hot-plates." E. Challet. March 10th, 1930. (369,373.)
7,279. "Mounting of electric switches, wall plugs, and the like in wall boxes." M. J. Railing and J. H. Collings. March 9, 1931. (369,377.)
8,357. "Control systems for synchronous electric motors." British Thomson-Houston Co., Ltd. March 20th, 1930. (369,385.)
8,482. "Electric circuit breaker." G. S. Marston and J. G. Statter. March 19th, 1931. (369,389.)
9,837. "Electrical immersion heater." R. A. Scrymgeour. April 1st, 1931. (369,417.)
10,849. "Point shifting device for electromagnetically operated points of toy railways." Märklin et Cie Ges., Geb., and R. Safft. May 6th, 1930. (369,426.)
12,033. "Electric clocks." Smith & Sons (Motor Accessories), Ltd., S. and P. O. Dorer. April 23rd, 1931. (369,438.)
12,326. "Electric switches." W. Quante. April 25th, 1931. (369,444.)
12,522. "Storage batteries." G. Pastrone. April 28th, 1931. (369,447.)
12,549. "Portable electric lamp." G. Polverini and A. Bagnasco. April 28th, 1931. (369,448.)
12,606. "Electric lamp holders." H. G. Baggs. April 29th, 1931. (369,449.)
13,876. "Machine for the manufacturing of electric primary cells for pocket lamp and the like batteries." W. Hasse. July 23rd, 1930. (369,460.)
14,242. "Electric remote control apparatus." Landis & Gyr Soc. Anon. May 17th, 1930. (369,462.)
17,374. "Thermionic amplifier circuit arrangements with parallel feeding." Naamlooze Vennootschap Philips' Gloeilampenfabrieken." June 21st, 1930. (369,480.)
20,946. "Construction of electric switch." R. W. L. A. Ham. July 22nd, 1931. (369,502.)
21,802. "Means for maintaining secrecy in telegraph and telephone transmission and reception." F. Chamier. July 30th, 1931. (369,504.)
22,093. "Electric vacuum switches." International General Electric Co., Inc. August 4th, 1930. (369,131.)
22,545. "Electric change-over switches, more particularly for use in wireless and like apparatus." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. September 25th, 1930. (369,508.)
22,702. "Luminous electric discharge tubes." General Electric Co., Ltd. August 15th, 1930. (369,509.)
23,474. "X-ray installations comprising an X-ray tube having an anode adapted to move." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 28th, 1930. (369,513.)
25,657. "Common wave broadcasting systems." H. Harbich. September 13th, 1930. (369,145.)
28,489. "Electrical machines suitable for use with motor vehicles." R. Bosch Akt.-Ges. October 17th, 1930. (369,532.)
28,803. "Dry galvanic cells of the Léclanche type." Pertrix Chemische Fabrik Akt.-Ges. August 8th, 1931. (369,157.)
29,742. "Production of magnesium by electrolysis in a molten bath." I. G. Farbenindustrie Akt.-Ges. November 8th, 1930. (369,536.)
29,935. "Electric resistances." Siemens-Schuckertwerke Akt.-Ges. February 7th, 1931. (369,161.)
31,175. "Röntgen tubes." Siemens-Reiniger-Veifa Ges. für medizinische Technik. November 27th, 1930. (369,166.)
31,587. "Thermionic amplifiers and oscillation generators." Marconi's Wireless Telegraph Co., Ltd. December 3rd, 1930. (369,167.)
31,821. "Electric massaging apparatus." G. Stockert and R. Stockert. April 21st, 1931. (369,538.)
34,709. "Low power induction motors." K. von Dreger and F. Beier. December 5th, 1931. (369,171.)
35,713. "Electric switchgear." General Electric Co., Ltd., and F. J. Keeley. November 3rd, 1930. (Divided application on 33,053/30.) (368,854.)

Trade Mark Applications

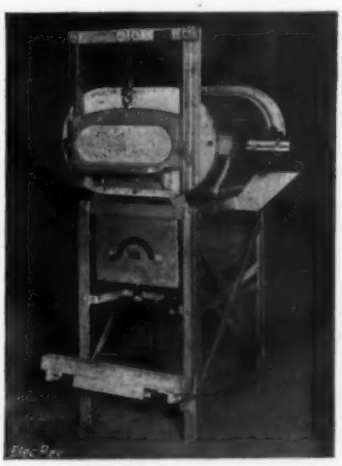
The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 6th:—

Oldham (lettering and design). No. 518,352. Class 8. Electric batteries and accumulators (not for medical purposes). Oldham (lettering only). No. 526,350. Class 13. Miners' electric lamps.—Oldham & Son, Ltd., 36, Hyde Road, Denton, Manchester.

Transwitch. No. 529,045. Class 13. Electric switches (ordinary) and fusible cutouts.—Metropolitan-Vickers Electrical Co., Ltd., Bush House, Aldwych, W.C.2.

A Self-contained Electric Furnace

THE heating chamber of a new furnace produced by Wild-Barfield Electric Furnaces, Ltd., is made of hard fireclay and the elements are of nickel chrome. The outer casing is sheet metal with insulated ends with castings back and front. The door is well insulated and pedal operated, while the heat controller mounted beneath the furnace is hand controlled. A pyrometer 0-1,000 deg. C. is fitted to the side of the furnace and a cut-out complete with signal lamp is embodied which automatically switches off the heating current at the upper limit.



Wild-Barfield "Garlz" Furnace

A double pole switch and fuses are mounted at the base, and the whole is mounted on a stand as is shown in the illustration of an 8-kW model.

The temperature range of the furnace is 250 deg.—950 deg., regulated by the temperature controller, which makes it suitable for hardening, reheating, case-hardening, tempering and general heat treatment. When used for case-hardening a special heat resisting metal tray must be used.

It is made in four sizes, with a maximum consumption of 3.8, 8.0, 8.7 and 15.0 kW, respectively. The furnace is designed for single-phase 200- to 250-V 50-cycle systems. Any of the furnaces can be fitted with a magnetic detector for indicating the exact quenching point of carbon, carburised and low alloy steel parts.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Reconstruction of the Electric Theatre.

Accrington.—Police station, fire station, and dwellings for the Town Council (£65,366); G. Cunliffe & Sons, builders, Accrington.

Altrincham (Cheshire).—Houses, Princess Street Estate (78), and Broad Heath (88); H. E. Brown, U.D.C. surveyor.

Ampthill (Beds).—Houses (22); L. Foster, surveyor, Flitwick, Bedford.

Arundle.—Alterations to Palladium Cinema; E. K. B. Wannock, architect.

Ayr.—Cinema (£25,000) for Crown Cinema (Ayr), Ltd.; A. V. Gardner, architect, Glasgow.

Ayrshire.—Extensions, St. Margaret's School, Ayr (£12,423); director of education, Ayr.

Banbury.—Houses (160); borough surveyor.

Barking.—Extensions to chemical works, Abbey Road; J. L. Rose, Ltd.

Barnard Castle (Co. Durham).—Alterations, Scala Cinema; Wetherell, Dent & Pickersgill, architects, Barnard Castle.

Bedford.—Houses (24), Renhold, Riseley, and Thurleigh; F. R. Chapman, architect, Council Chambers, Bedford.

Birmingham.—Houses (3,500); Housing Committee. Houses (160), Great Brook Street; city engineer. Cinema, King's Road, Kettlestone Estate; Parker, Deutsh & Turner.

Blackpool.—Theatre, Britannia Place; P. B. Broadhead.

Bootle.—Houses (22), Bailey Drive; H. Boot & Sons, Ltd., Sheffield.

Bradford.—Houses (300), Dick Lane, Tyersal; Sutton Dwellings Trust.

Bristol.—Alterations to schools at Shirehampton, Southmead, Marksbury Road, and Bedminster, for Bristol E.C. (£90,798).

Brownhills (Staffs).—Rebuilding the Turf Inn, Watling Street; H. E. & E. Farmer, architects, 57, Colmore Row, Birmingham.

Bury St. Edmunds.—Rebuilding Three Kings Hotel, with arcade of shops, for Hunter & Oliver, Ltd.

Cambridge.—School, Fen Ditton; County E.C.

Cardiff.—Amusement hall, Barley Mow Lane; F. W. Morgan, Peretgate, Llandaff.

Caterham.—Church, Banstead Road, for Rev. W. E. Goundry; W. Harbrow, Ltd.

Catterick (Yorks).—Post office, &c.; H.M. Office of Works, King Charles Street, S.W.1.

Cheshire.—Two schools (720 places), Wellington Road, Timperley; director of education, Chester. Extensions to Hyde Technical School; County E.C.

Chesterfield.—Rebuilding tannery, Clayton Street, for J. Clayton & Sons, Ltd.

Darlington.—Extensions to Darlington Rolling Mills; Dougill & Sons, builders, Darlington.

Dartford.—Bungalows (26), Burnham Road; Foakes & Richards.

Derby.—Bus station; C. H. Aslin, borough architect, Gower Street.

Devon.—North Devon Isolation Hospital; county architect.

Dewsbury.—Houses (32), Lees Holme Estate; borough engineer.

Dollar (Clackmannanshire).—Town hall; borough surveyor.

Dumfries.—Houses (96), Sandside, Maxwelltown; borough surveyor. Houses (£3,500); Carruthers Trust, Dumfries.

Durham.—Housing scheme, Framwellgate; W. J. Greene, city engineer, Town Hall. School, Burnopfield, for County E.C.

Eastbourne.—Reconstruction of Royal Hippodrome, Seaside Road; T. W. Bennett & Sons.

East Preston (Sussex).—Houses (20); R.D.C. surveyor, Rustington.

Edinburgh.—Restoration after fire of Bonnington Bridge Paper Mills; W. N. Thomson & Co., architects. Constitution Street, Leith. Extensions to Nurses' Home, Bangour; Public Health Committee.

Faringdon (Berks).—Houses (54); R.D.C. surveyor.

Flintshire.—Central school, Flint; director of education, Mold.

Folkestone.—Houses (20); Streek & Co., builders, Blackheath, London, S.E.

Glasgow.—Factory, Claythorn Street, for Drysdale & Gibb; J. G. Aitchison, architect, 170, Hope Street.

Glossop.—Housing scheme for the Corporation.

Gomersal (Yorks).—Extensions to mills for T. Burnley & Sons, Ltd.

Grangemouth (Stirlingshire).—Pump house and extensions for Scottish Oils, Ltd. (£3,000); the secretary, 32, Bothwell Street, Glasgow.

Guestling (Sussex).—Electrical installation at Eighteen Pounder Farm; Major Hocker.

Haslingden.—Covered market (£8,000); borough surveyor.

Hastings.—X-ray apparatus for hospital (£892); Corporation Health Committee. Extensions, Municipal Hospital (£15,228); E. D. Winn & Co., Ltd., builders, 36, Wilton Place, Knightsbridge, S.W.1. Premises for Marks & Spencer, Ltd., Queen's Road; W. A. Lewis & Partners, architects. Development, Tile Kiln Farm Estate; Callow & Callow, architects.

Hetton-le-Hole.—Houses (100); A. H. Fennell, architect, Chester-le-Street.

Highfield (Durham).—R.C. school; P. McManemy, builder, Westoe Road, South Shields.

High Wycombe.—Waterworks pumping station; W. Vaux Graham, engineer, 5, Queen Anne's Gate, S.W.1.

Hitchin.—Extensions to Poor Law buildings (£31,710); W. H. Hobday, architect.

Hoyland (Yorks).—Houses (30); U.D.C. surveyor.

Irish Free State.—(Ballina).—Houses (35), Kilhola Road, for the U.D.C. (Crumlin, Co. Antrim).—Church for Rev. H. H. Murphy. (Dublin).—Schools, Crumlin Road; Thomas J. Cullin, architect, 25, Suffolk Street.

Leeds.—Cinema, Vicar Lane; Associated British Cinemas, Ltd.

Lee-on-the-Solent (Hants).—Church (£10,000); Seely & Paget, architects, 3, Queen Square Mews, S.W.1.

Liverpool.—Houses (246), Speke Road, Garston; director of housing, Municipal Annexe, Dale Street.

London.—(Haymarket).—Improvements to the Carlton Hotel; the manager. (Leyton).—Block of 48 flats (£26,000), Whitehouse Estate; borough surveyor. (Plaistow).—Cinema, Barking Road; R. Cromie, architect, 35, Baker Street, W.1. (Stratford).—Alterations to Stratford Empire Theatre; William and Thos. R. Milburn, 17, Fawcett Street, Sunderland.

Luton (Beds).—Houses (36), Portland Road, for J. Frost. Houses (20), Gardenia Avenue, for Seaward Bros.

Macclesfield.—Power house, Gunco Lane, for Blackhouse and Coppock; J. Clayton, Ltd., contractors, Sutherland Street.

Manchester.—Houses (130), Anson Estate; city architect.

Middlesex.—School (500 places), Kingsbury; County E.C.

Newbury.—Council School (£6,000); G. R. King, builder, Northampton.

Malvern.—Houses (50); U.D.C. surveyor.

Northallerton (Yorks).—Houses (25) for the U.D.C.; D. Oakley, builder, Northallerton.

Northern Ireland.—(Belfast).—Rebuilding of the Metropole Hotel, York Street; T. D. Purdy, architect and surveyor, 10, Donegall Square East, Donegall.

Oundle (Northants).—Houses (20), for the Workmen's Housing Association.

Portsmouth.—Church, Drayton (£7,000), for the Wesleyan trustees; Rev. R. Stafford Brealy.

Redditch.—Houses (110), Salters Estate; U.D.C. surveyor. Fountain Inn, Evesham Street; Dares Brewery, Ltd.

Ruabon (Denbighshire).—Dairy for the Cefn and District Co-operative Society, Ltd., Rhosymedre; architect's department, C.W.S., Ltd., Balloon Street, Manchester.

Rye (Sussex).—Houses (24); R.D.C. surveyor.

Scarborough.—Building estate, near Lady Edith's Drive; J. W. Read.

Sedgefield (Durham).—Houses (500); R.D.C. surveyor, Council Offices.

Sheffield.—Houses (240), Shiregreen Estate; W. G. Davies, city architect, Town Hall.

Shipston-on-Stour.—Houses (40); R.D.C. surveyor.

Spenborough (Yorks).—Houses (50), Firthcliffe Estate; U.D.C. surveyor, Cleckheaton.

Stourbridge.—Block of shops and arcade, High Street, for D. Poole.

Stretford.—Totalisator buildings, White City; Greyhound Racing Association.

Swindon.—Housing scheme (38 acres), Rodbourne Cheney; Corporation.

Swinton & Pendlebury.—School, Moorside; education authority.

Teignmouth (Devon).—Houses (36), Mill Lane; U.D.C. surveyor.

Thames Ditton.—Rebuilding factory, Orchard Lane, Imber Court, for the Metropolitan Concrete Works, Ltd.; F. Eve, architect.

Tilbury (Essex).—Electricity showroom, offices, &c.; S. A. Hill-Willis, U.D.C. surveyor.

Tonbridge.—Houses (26), for the U.D.C.; F. & A. Mason, builders, Catford, S.E.

Truro.—Houses (50), for the T.C.

Tynemouth.—Rebuilding of Colonel Linskill Hotel for Newcastle Breweries, Ltd.; J. Oswald & Sons, architects, 21, Worswick Street, Newcastle-on-Tyne. Alterations to the Grand Hotel; D. Peel, builder, North Shields.

Warrington.—Showrooms and offices; S. A. H. Mackie, architect, 2, Bold Street Chambers.

Waterfoot (Lancs).—Extensions to mill for J. Butterworth and Son, Dale Mill; A. Brocklehurst, architect, St. James Chambers, Waterfoot.

West Kesteven (Lincs).—Houses (32); R.D.C. surveyor, 19, Watergate, Grantham.

Weston-super-Mare.—Re-erection of Grange Hotel, Worlebury Hill, for E. Salisbury.

Widnes.—Houses (132); borough surveyor.

Wilmslow (Cheshire).—Cinema, Water Lane, for F. W. Banks.

Woodbridge (Suffolk).—Fruit canning factory; Hooper and Garrard, architects, 6, Butter Market, Ipswich.

Worthing.—Theatre, Marine Parade; C. A. Seabold. Shops (18) and houses (3), Liverpool Road; M. R. Fletcher. Houses, Shandon Road (42), and elsewhere (11); H. M. Potter.

Yorkshire.—Railway stations, Beningbrough, Alne, and Otterinton; L.N.E. Railway Co.

Induction Heating in Greenhouses

A small greenhouse near Pasadena, California, is being warmed on the induction principle at an initial cost which, the *Electrical World* states, is only about one-half of that for a steam or hot-water system. No. 12 asbestos-covered monel wire in ¼-in. steel tube is used. One circuit consisting of 158 ft. of wire and conduit is connected to a 220-V supply the loading is 5.9 kW, giving an energy dissipation of 37.5 watts per ft. run. The temperature of the surface of the conduit may reach 240 deg. F. with an ambient temperature of 75 deg. F. Energy consumption averages about 0.2 watt per sq. ft. of glass area per degree difference in temperature between outside and inside air.